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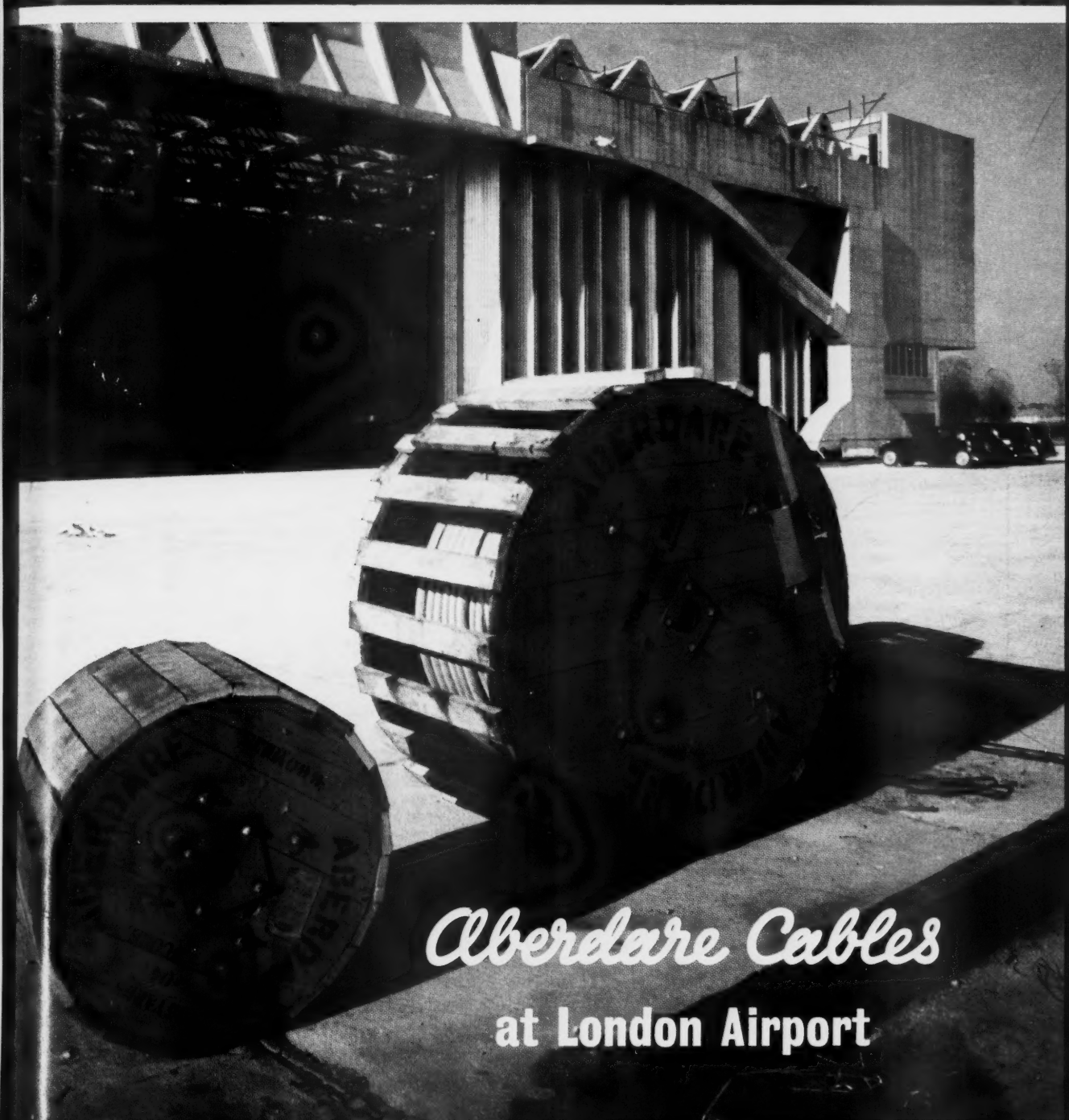

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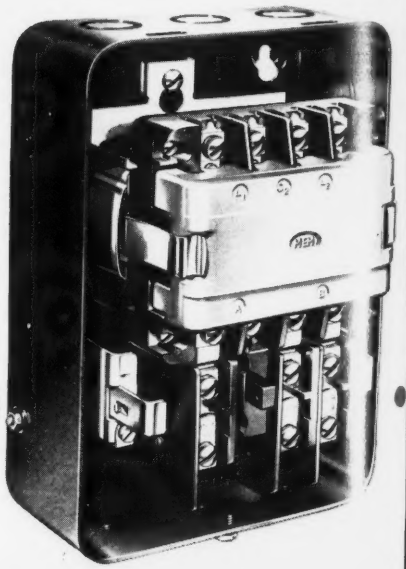

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ELECTRICAL REVIEW

Managing Editor: HUGH S. POCOCK, M.I.E.E.
General Editor: J. H. COSENS
Technical Editor: P. W. TUCKER, M.I.E.E.

28 JANUARY 1955

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Eighty-Third Year of Publication

FRIDAY ✧ ONE SHILLING

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Editorial, Advertising and Publishing Offices : Dorset House, Stamford Street, London, S.E.1. Telegraphic Address : "Elecrev, Sedist, London." Code : ABC. Telephone No. Waterloo 3333 (60 lines). Registered at the General Post Office as a Newspaper. Entered as Second Class Matter at the New York, U.S.A., Post Office. Annual Subscription : Home and Overseas £3 6s 0d : U.S.A. and Canada $11.00. Cheques and Postal Orders (on Chief Office, London) payable to ELECTRICAL REVIEW PUBLICATIONS LTD., and crossed "Lloyds Bank."

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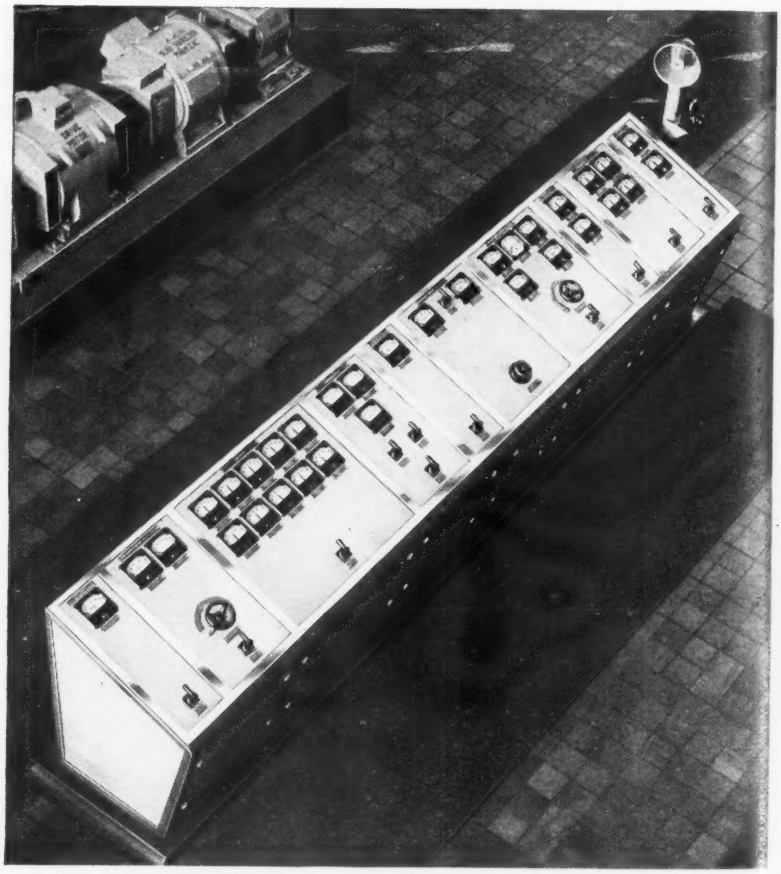

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ELECTRICAL REVIEW

28 January 1955 Vol. 156 No. 4 Established 1872

The Railway Plan

As our readers well know, the *Electrical Review* has long held that salvation could come to the British railway system only by thorough modernization—a term which is largely synonymous with electrification. It is therefore with the greatest satisfaction that we receive the British Transport Commission's Plan for the modernization and re-equipment of British Railways, the main features of which are set out in this issue.

While it may not be considered to go so far or so quickly with electrification as might be desired, the Plan represents a remarkable revolution in the ideas of those who control the railways; it is nothing less than the eventual elimination of the steam locomotive, for long the justifiable pride of the mechanical engineer. It may be to soften the blow that the Plan envisages a rather protracted interval of diesel operation as a prelude to the complete electrification of the main lines. The reason given is that traffic will be so built up during this period as to fully justify main-line electrification, although, as Mr. W. B. Noddings suggested in our special railway electrification issue last May, there are already 4,000 route miles which it would pay to electrify.

In the same issue Mr. C. M. Cock, who was chairman of the 1951 Committee which reported on the subject, quoted that Committee's opinion that at least half of the country's railways could be profitably electrified and he put the cost at £600 million, including signalling, spread over twenty-five years—£24 million a year. The British Transport Commission proposes to spend about £185 million on main-line electrification (excluding the cost of multiple-unit electric trains) over fifteen years, or £12·3 million a year. In the same period expenditure upon main-line diesel locomotives would be £125 million. It may be questioned whether it would not be better to proceed faster with electrification (the eventual goal) and spend less on diesel traction.

There is a note of doubt in the Commission's statement that it is taking expert advice as to the capacity of the technical staff and of the electrical manufacturing industry to carry out the electrification covered by the Plan. So far as the electrical manufacturing industry is concerned the answer was given by Messrs. E. T. Hippisley and J. C. Way in our electrification issue. They said that it was possible to meet even the requirements of the 1951 Report and still have ample capacity for export business. So there need be no qualms in this respect.

Apart from the actual work of electrification and the provision of rolling stock, execution of the Plan will mean a considerable amount of ancillary work for the electrical industry. There is to be a widespread replacement of semaphore signals by colour-light signalling, a considerable extension of track-circuiting and provision of power-operated signal boxes. Moreover the modernization of freight handling methods postulates the installation of much electrically-operated equipment.

Implementation of the Plan will cost a great deal, but in relation to the general national investment it will not be unreasonable. Indeed it would be unreasonable of the Government not to approve an expenditure which will not only rescue the railways from their present run-down state but do it at a profit.

ELECTRICAL EXPORTS IN 1954

With the issue of the December statistics of overseas trade it is possible to assess the electrical export position for the whole of last year. The Board of Trade shows that in 1954 exports of all kinds from this country had a total value of £2,673 million, a record figure and near 4 per cent above the 1953 total. It is not easy to trace all the electrical exports in the Board of Trade returns. Now that the Board employs the Standard International Trade Classification (see *Electrical Review*, 1st January, 1954, p. 17) there has been some improvement, but there are still many classes of electrical goods appearing in other sections than Class D, Division 16—" Electric machinery, apparatus and appliances." In a table included in our review of last year's electrical export trade on another page we set out some of these classes. Thus although exports of " electric machinery, apparatus and appliances " are shown to have declined from £172·6 million in 1953 to £170·1 million last year, the decrease is certainly counterbalanced to some extent by a rise of over £1 million in the separate classes which we show in our table and possibly offset further by increases in the " non-distinguishable " classes. These classes are those which embrace electrical equipment or are closely associated with it, but from which it is impossible to separate out the electrical components. We may quote as examples boiler plant and air conditioning and refrigerating plant.

DOLLAR TRADE

As we show in our survey, the countries of the British Commonwealth remained our best electrical customers, their share of the total last year being £103·45 million or about 60 per cent. It is seen, however, that this was less than in 1953 (£110·15 million). Exports to foreign countries (which include the Republic of Ireland) rose from £62·43 million to £66·69 million. Great importance is attached to dollar exports and therefore it is satisfactory to see a slight improvement in this direction, although it was the United States and not Canada which was responsible for it; Canada's purchases were, in fact, a little lower in 1954, at £8·26 million while those of the United States went up from " non-distinguishable " classes.

LIGHT AND HEAVY CURRENT

Up to the time of the introduction of radio, light current and heavy current electrical engineering had very definite meanings which were aligned with the terms, and because of the conditions of that time light current engineering meant almost exclusively telecommunication engineering. Now light current engineering is often used to mean electronic engineering and confusion arises from this because electronic engineering is a specialized branch of electrical engineering which yet is dovetailed closely with other specialized branches, for instance, radio, in which connection it fits in so well with the term light current engineering. Again, electronic control, by virtue of its minute currents which can be amplified so accurately, is nowadays associated closely with the heaviest of industrial engineering, affording, *inter alia*, precise speed control of many of the largest electric drives so far developed—large steelworks rolling mill drives for instance. Actually we think it is a pity that the term electronic control is used at all, for it tends to divorce a particular section of electrical engineers from the major body, while at the same time it does not properly describe the section of electrical engineering—radio—which gave birth to the term.

TRANSFORMER OIL

As a remedy for the reduction in useful life of transformer oils on account of oxidation when in contact with the atmosphere, the sealing of transformers should give better results than are obtainable with conservators. In his I.E.E. paper, reported on another page, Mr. E. B. Franklin referred to the " almost universal " use of sealed transformers in one form or another in the U.S.A. In view of the number of points that have still to be cleared up, as the author showed, especially in regard to the reduction of electric strength of oil due to negative tank pressures and excess amounts of gas in solution, there appears to be justification for the more cautious attitude of the Midlands Electricity Board and Electricité de France, both of whom seemingly regard sealing as still in the experimental stage.

TIDAL ENERGY

The estimate of one million MW mentioned by Professor R. Gibrat at the Institution of Civil Engineers last week as the world potential of the tides provides an example of hitherto virtually untapped power resources which could be made available to eke out dwindling coal supplies when it becomes economical to do so. For the Severn Barrage report the economic criterion taken was the comparative price of coal (which is now higher than the break-even point), but another factor was the number of non-firm kilowatts that could be absorbed by the grid at times of low electrical demands. Professor Gibrat put the total power available from the English Channel at 80,000 MW, that is about four times the installed capacity of B.E.A. power stations. The Rance project in Brittany, with which he was principally concerned, he said would cost little more than a low-head hydro-electric scheme of similar output.

ELECTRIC KETTLES

The next in our series of illustrated surveys of domestic electrical appliances will appear in our issue of 4th February, when we shall be dealing with electric kettles. Information, given in tabular form, will include details of the capacity, type of element and loading, finish and composition of handle and body, price and any other special features. In view of the continued demand for these surveys for reference purposes, orders for additional copies of the *Electrical Review* should be placed without delay. The succeeding survey (25th February) will deal with vacuum cleaners

POWER FOR STEEL ROLLING

Driving Equipment for an 11in Continuous Bar Mill

IN the spring of 1950 work started at the Rotherham works of the Park Gate Iron & Steel Co., Ltd., on the installation of an 11in continuous bar mill and by September, 1953, rolling had commenced. The plant was developed and arranged by the Brightside Foundry & Engineering Co., Ltd., which designed, made and obtained all the machinery and associated equipment, while the building and civil engineering work was carried out under the direction of Messrs. Bylander and Waddell. The bulk of the electrical equipment was supplied by the English Electric Co., Ltd., as sub-contractor to Brightside.

The mill has seventeen stands of two-high rolls arranged in a fully continuous manner, each stand being individually electrically driven. The stands are divided into three groups: a five-stand 16in roughing train, a four-stand 12in intermediate train, and an eight-stand 11in finishing train. The raw material for the mill comprises billets 4in or 3in square and 18ft long which are heated in either of two oil fired furnaces before being fed into the mill. Various grades of steel are processed to produce round, hexagonal or square bar in all sizes from $\frac{3}{8}$in to $1\frac{1}{4}$in.

Fast response and close speed regulation of the mill motors are essential and are achieved by using boosters in the motor armature circuits, operating in conjunction with magnetic amplifiers feeding the booster fields; this is the first mill in this country to employ this form of control. Control of motor speed by voltage control of a booster in the armature circuit gives rapid speed recovery to meet fluctuations in load, and reduces the period of impact drop. The response is far superior to that obtainable by field control on the mill motor.

For accuracy of product, it is essential that there should be no tension in the bar as it goes through the finishing stands, so pneumatically-operated looping troughs are provided between stands which open automatically and allow small loops to form in the bar. To avoid "snatching" of the front end of the bar as it enters a mill stand, the no-load speed of the mill motor must be the same, within very close limits, as the on-load speed. The necessary close speed regulation is achieved by voltage control of the booster in the mill motor armature circuit. To avoid the forming of excessively large loops in the bar between stands, recovery of the mill motor to its pre-set speed after the initial impact drop caused by entry of the bar into the stand, must be rapid. Magnetic amplifiers feeding the booster fields force the booster volts to counteract the impact speed drop and the actual speed drop is lessened and quickly recovered. Armature circuit boosters with magnetic amplifiers are also provided for the motors on the roughing section of the mill.

The complete power distribution, drive and control scheme is shown in diagrammatic form in Fig. 1, while Fig. 2 shows the drive scheme connections.

Each of the seventeen mill stands has its own driving motor rated as shown in the table. The "speed cone" for the mill requires each motor to have a speed range of about 4 : 1. This range is covered mainly by shunt field control which gives a speed range of about 3 : 1 the rest being achieved by voltage control of the appropriate section of the main d.c. bus.

TABLE I

Stand No.	Motor h.p.	Motor r.p.m.
1	125	250/750
2	175	250/750
3	225	250/750
4	300	250/750
5	400	333/1,000
6	500	333/1,000
7	500	333/1,000
8	600	325/1,000
9	600	325/1,000
10	600	325/1,000
11	600	325/1,000
12	600	325/1,000
13	600	325/1,000
14	600	325/1,000
15	600	325/1,000
16	600	325/1,000
17	600	325/1,000

The main variable-voltage d.c. bus is split into four sections by bus section isolators and each section is fed by one of the four main 1,500 kW generators. The mill as a whole is Ward-Leonard

controlled in the normal manner by voltage variation of the generators. The section switches in the main bus may, if required, all be closed and the generators will then operate in parallel. Each generator has a negative series winding which ensures accurate load sharing, and the output of the exciters supplying the generator shunt fields is controlled by a magnetic amplifier to maintain the busbar volts constant.

To increase the overall speed range between various sections of the mill train, the d.c. bus can be split into either two, three, or four sections by bus section switches, and the voltage on each may then be set to suit the requirements of any particular mill programme. A magnetic amplifier on each section maintains constant volts irrespective of load. Once the voltages on the various sections have been set in the correct relationship to each other by the generator voltage setting rheostats, the master reference rheostat is used to control the speed of the whole mill. All these rheostats are " Selsyn " operated and controlled from the main mill pulpit desks.

The series booster in each mill motor armature circuit gives close speed regulation control down to a minimum of 0·5 per cent. Each mill motor has both coarse and vernier field rheostats, the former being " Selsyn " operated and the latter hand lever operated.

When setting up the mill for a new programme, it is often desirable that the motors should have a fairly coarse regulation because if the speeds are not quite correct, some motors may trip out on overload and others may act as generators. The regulation control has therefore been made adjustable so that as the motor speeds are more accurately determined, the regulation may be reduced.

The main generator and mill motor circuit breakers are remotely controlled and normally operated by the mill pulpit operators. These breakers can only be closed when the main d.c. bus volts are zero. Under emergency conditions the mill may be brought to a rapid stop by rapidly reducing all generator voltages in step and at a controlled rate to zero, so forcing the mill motors to regenerate.

From the main supervisory control board in the motor room the main m.g. sets, boosters and exciters are controlled, and the motor circuits are set up ready for control to be taken by the mill operators at the roughing and finishing mill desks. Each section of the equipment is metered on this board and each mill motor has its own recording ammeter.

The main d.c. circuit-breaker board in the motor room basement is equipped with double-pole, solenoid operated armature air circuit breakers for the mill motors and the main variable voltage generators. The connections from this board to the main generators are copper busbars supported in hardwood cleats which are hung from steel supports in the basement ceiling. Connections to the mill motors and boosters are cables laid and clipped in perforated steel trays suspended from the basement ceiling.

The magnetic amplifier cubicles for the mill motors and main generators are also in the motor room basement and each cubicle is fitted with a set of miniature ammeters

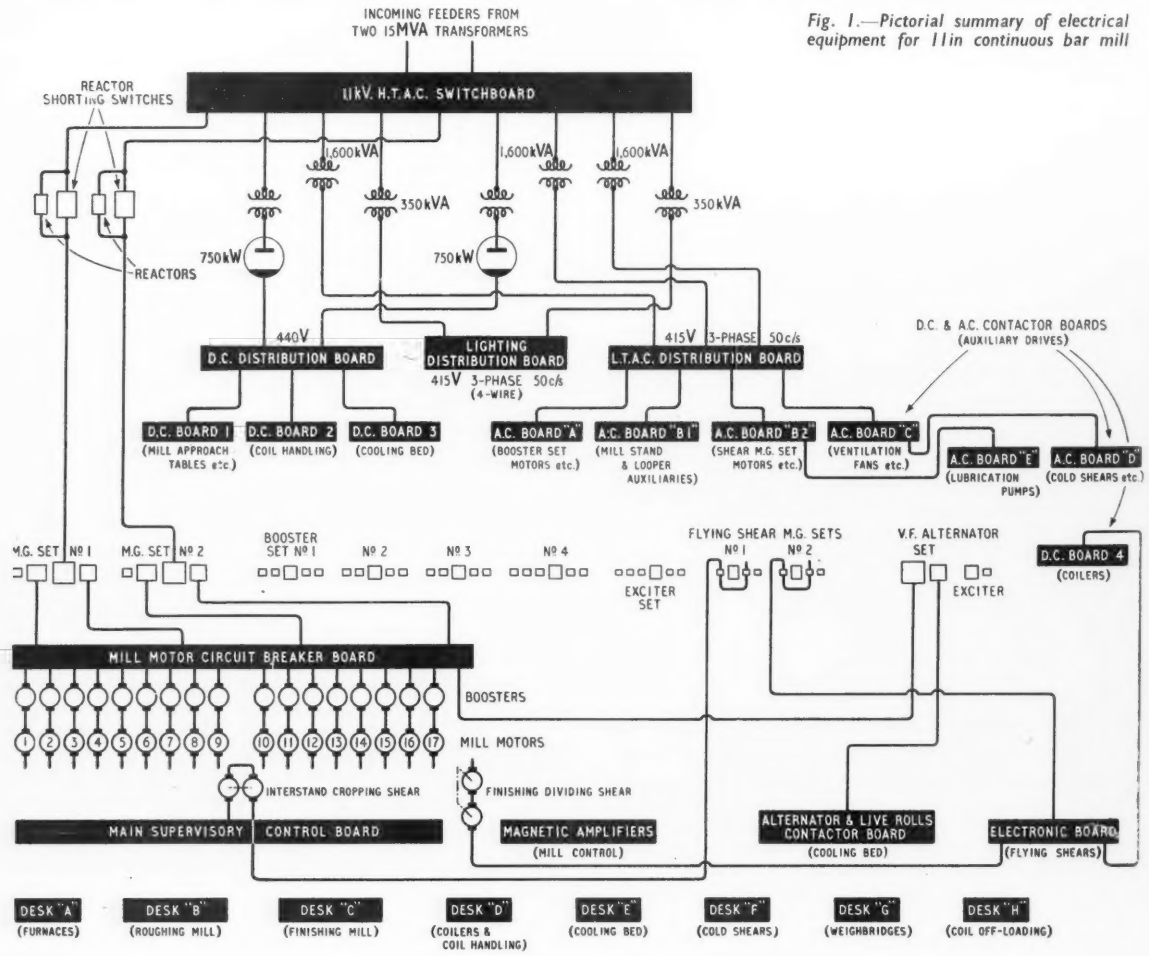


Fig. 1.—Pictorial summary of electrical equipment for 11in continuous bar mill

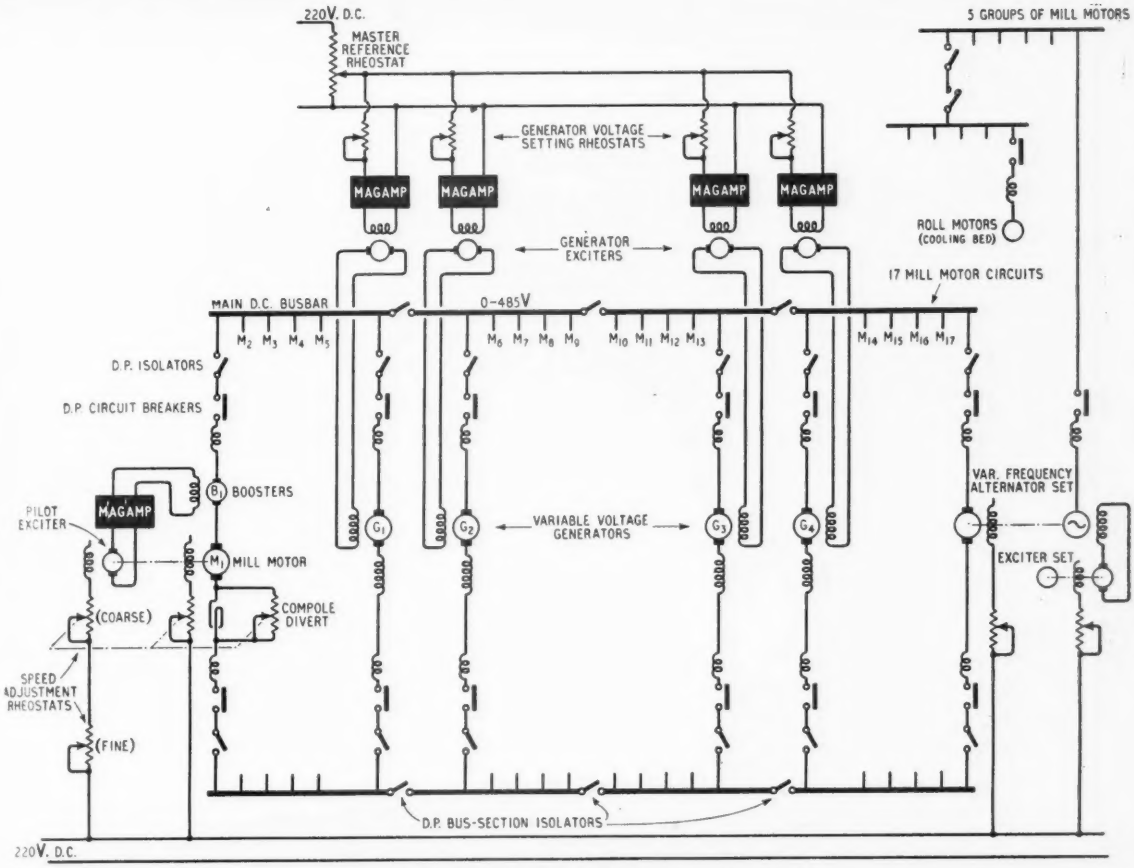


Fig. 2.—Main connections for the 11 in continuous bar mill drive

The billets are first heated in either of two oil-fired furnaces

The roughing train control desk

and voltmeters for indication of conditions existing in the various amplifier circuits. An open type contactor board fitted with primary resistance contactor starters for the booster sets, exciter set and flying shear m.g. sets is in the motor room basement. It is also equipped with direct-on-line starters for various auxiliary drives.

All the mill motors are controlled from two desks in pulpits overlooking the mill. The roughing mill desk has controls for motors 1–9 inclusive, which drive the roughing and intermediate mill stands, the two main variable voltage generators G1 and G2, shown in Fig. 2, the mill approach tables and the interstand cropping shear. The finishing mill desk has controls for motors 10–17 inclusive, which drive the finishing horizontal and vertical mill stands, the two main variable voltage generators G3 and G4, the pneumatically operated looping troughs between the mill stands, the finishing dividing shear and the cooling bed live-roll motors and variable-frequency motor-alternator set which supplies them. Speed control of the whole mill, i.e., voltage control of all generators, is normally carried out by the finishing mill desk operator who is the " master " operator. Complete lubrication and ventilation systems are provided and are fully interlocked with the main mill control system.

The whole of the electrical equipment for the mill is fed from two 15 MVA, 66/11 kV transformers, supplied by the Yorkshire Electricity Board, one of which is capable of carrying the whole load. The 11 kV cables from the transformers are brought to two incoming units, one on either side of a bus-section unit, incorporated in a single busbar, solenoid operated, metalclad oil circuit-breaker board of 250 MVA rupturing capacity. From this board there are nine outgoing cables which feed respectively two 4,400 h.p. synchronous m.g. sets, three 1,600 kVA, l.v. a.c. distribution transformers, two 750 kW distribution rectifier equipments, and two 350 kVA l.v. a.c. lighting transformers.

Each of the two main m.g. sets, which are reactor started, comprises a 4,400 h.p. salient-pole synchronous driving motor and two 1,500 kW variable voltage d.c. generators which supply the seventeen mill stand motors and the variable-frequency set driving motor. The three 1,600 kVA, 11,000/415 V transformers supply all the l.v. a.c. auxiliary drives and ancillaries. Two transformers are capable of keeping the mill running.

The 750 kW mercury arc, pumpless steel tank rectifiers, one of which can supply the whole of the load, feed all the d.c. auxiliary drives associated with the mill, coilers, coil handling equipment and the cooling bed. Lighting and heating supplies are taken from a 415 V three-phase four-wire combination fuse-switch board which is fed by the two 350 kVA transformers.

The three 1,600 kVA distribution transformers feed a 415 V, three-phase, three-wire, cubicle type class " OB " hinged isolating, solenoid operated air circuit-breaker board. Bus section units are arranged between the three incoming units and seven outgoing units feed the various l.v. a.c. auxiliary drive contactor boards. Each board has two incoming supply cables and is equipped with a small

General view of the mill from the finishing train end showing the four coilers in the foreground

transformer and metal rectifier set for feeding the contactor coil and relay circuits.

The two 750 kW rectifiers feed a 440 V, two-wire cubicle type, hinged isolating, solenoid operated class "OB" air circuit-breaker board, the two incoming units being arranged on either side of a bus section unit. Six outgoing units feed the various d.c. auxiliary drive contactor boards, each contactor board having two incoming supply cables, either of which may be used.

All circuit breakers, apart from the two incoming units on the h.v. a.c. board, can be controlled remotely from the main supervisory board in the motor room.

Flying Shears

There are two flying shears, one between stands 9 and 10 after the roughing train and the other after the finishing train immediately behind stand 17. The interstand shear is driven by two 75 h.p. 515 r.p.m. d.c. auxiliary mill type motors, connected in series and the duty of the shear is to crop the front end of each bar before it enters the finishing train. Under emergency conditions, such as may arise when a cobble occurs in the finishing train, this shear may be set running continuously to crop the bar up into short lengths and prevent material from piling into the cobble.

The shear motors are fed from a variable voltage m.g. set, the voltage being maintained proportional to the speed of the bar as it leaves the last stand before the shear, which may be either stand 7 or 9. This ensures that the linear speed of the shear knives at the "cut" position is exactly matched to the linear speed of the bar passing under the shear knives. Electronic control is used for rapid acceleration, deceleration and resetting of the shear motors. Current relays in the mill motor armature circuits, or alternatively photocells, operating in conjunction with electronic timers, are used to start the shear for each cut.

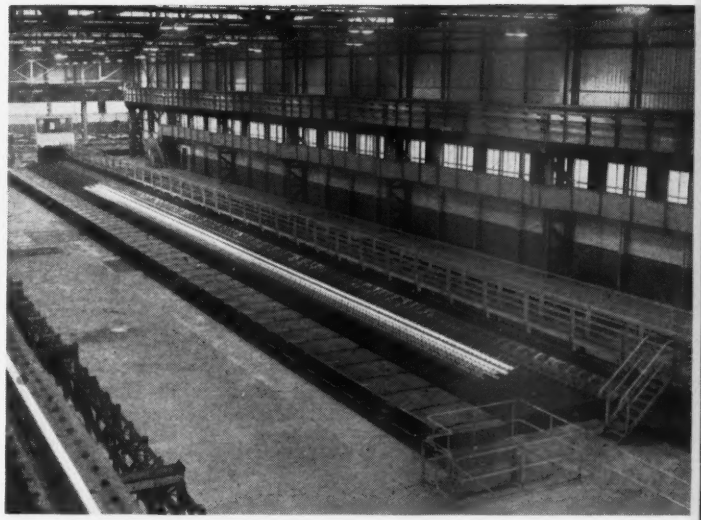
A similar form of control is used for the finishing shear, which divides the bar up into lengths ranging from 170ft to 230ft as it leaves the finishing train before passing forward to the cooling bed. It is designed for operation with bar speeds up to 2,000 ft/min and the two driving motors, in series, are each rated at 100 h.p., 485 r.p.m.

The repetitive shear action for cutting a bar into lengths is controlled by an inverse timer and a photo-cell to detect the front end of each bar as it passes beneath the shear blades. This gives very high accuracy and the lengths of bar sheared can be consistently maintained within $\pm$ 6in on any length within the above range.

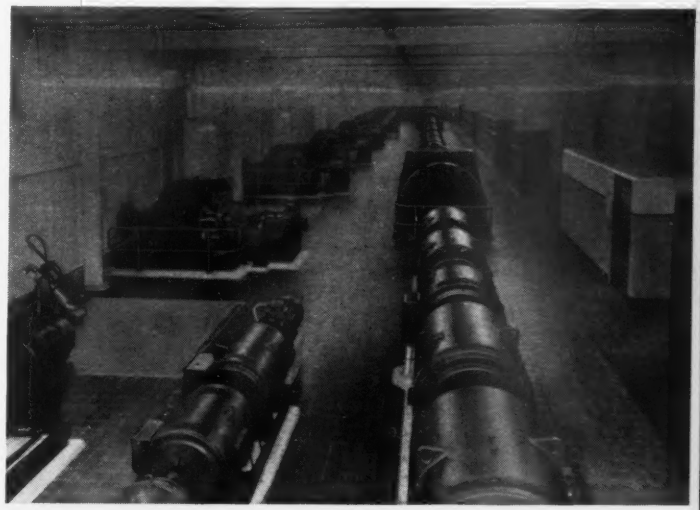
Cooling Bed and Cold Shear

The cooling bed roller motors and the roller motors on the approach table to the cooling bed are of the variable frequency, squirrel-cage type fed from an alternator whose d.c. driving motor is fed from the main mill d.c. bus. The speed of the variable frequency alternator set, and hence the roller motors is proportional to mill speed. A rheostat in the d.c. driving motor field circuit is used to adjust the speed of the v.f. set in correct relationship to the mill speed to suit the particular product being rolled.

All other drives associated with the cooling bed are of the d.c. auxiliary mill type with standard contactor control gear. The drives for the "apron lift," "apron kick-off," "plunger lift" and "carry over" are fully automatic in operation, each of the four drives performing its cycle of operation in sequence. The first of the four drives, the apron lift, raises the rod or bar on apron plates situated between the rollers, preparatory to being "kicked off" into the first straightening pocket, and this drive is automatically started when the front end of the bar is a certain distance from the end of the bed. This distance varies with the speed of the bar and some few feet are covered before the bar skids to a stop in the straightening pocket.



After leaving the flying shear the bar is conveyed by driven rolls on to the mechanical cooling bed



General view of the main mill motor room

The point at which the bar is raised on the apron plates is determined by the cooling bed operator who has control of an electronic timer, which can be adjusted to give the delay necessary between the start of the apron lift drive and the time at which the finishing dividing shear makes a cut, or the tail end of the bar passes the shear. An adjustable timer is also provided for fixing the time interval between operation of the apron kick-off drive and operation of the plunger lift which ejects the bar out of the first straightening pocket. This time delay allows the bar to come to rest in the pocket before being ejected.

All the above automatic drives are provided with alternative hand control by master switch together with inching control in both forward and reverse directions, this feature being useful for clearing any bar which may become jammed as a result of a cobble on the cooling bed. Control of most of the drives is carried out from a desk in a pulpit at the end of the cooling bed remote from the mill.

After traversing the cooling bed, the bars are collected

in groups against disappearing stops and then run out to the 250 ton cold shear for final shearing into lengths, which are then weighed and bundled ready for despatch. The cold shear and measuring beam stop, together with the cooling bed runout tables to the shear and the first section of the runout table to the weighbridge, are controlled from a desk close to the shear itself. The weighbridge tables, the chain throw-off drives and the disappearing stops in the tables are controlled from another desk.

The l.v. a.c. and d.c. contactor boards for all the drives associated with the cooling bed, cold shear and weighbridges are of the open type and are situated in a basement close to the bed. This basement also houses the variable-frequency motor alternator set and the l.v. a.c. contactor board for the cooling bed live roller motors.

Some products are coiled after leaving the mill. In this case, the finishing shear is not used and the m.g. set which supplies the shear motors when rolling straight products is used to supply the four coiler motors. Each coiler motor is rated at 0/200/200 h.p. at 0/1,100/1,800 r.p.m., and has its own contactor gear for starting and dynamic braking.

When two, three or four coilers are being used, the bars are automatically diverted to the coilers in a pre-determined sequence. The switch tube which diverts the bars into the coiler guide tubes is hydraulically operated and oil is admitted to the cylinders by electromagnetic solenoid operated valves. These valves are actuated in a pre-determined sequence by current relays in the mill motor armature circuits operating in conjunction with an adjustable timer. If any coiler is not up to speed, it is by-passed and the next coiler in the sequence which is ready and running at speed is automatically selected.

Each coiler motor is automatically started up when the coil just wound has been cleared and the coiler ejector plate has returned to its bottom position. When a particular coil has been wound, the coiler motor is automatically dynamically braked to rest, the dynamic braking contactors being actuated by one of the mill motor armature circuit current relays operating in conjunction with a timer, which is adjustable and under the control of the coiler desk operator. The coiler having been brought to a stop, the "ejector lift" or ejector plate drive is automatically started up and the coil is raised clear of the guide pins. When fully ejected, the coiler push-off gear, which is hand-controlled by a master switch, may be started and the finished coil is pushed on to a slat conveyor.

As for the shears, the voltage of the generators supplying the coiler motors is maintained proportional to the linear speed of the bar as it leaves the last mill stand, but a rheostat in the generator field circuit may be used to alter this relationship and to change the speed of all coiler motors. This facility is useful when changing the size of head on the coilers for producing different sized coils. Rheostats in the coiler motor field circuits provide individual speed adjustment of the coiler motors, and the field range is also partially used when the coilers are put on "hunting" control. In order to form a compact and evenly wound coil, the speed of each coiler motor may be varied automatically and continuously between limits of approximately $\pm 7\frac{1}{2}$ per cent of the pre-set speed, this control being achieved by using a motor-operated rheostat with a small resistance track in each motor field circuit.

The finished coils, having travelled the full length of the slat conveyors, are deposited into loading spoons, operated either individually or simultaneously, which transfer the coils on to the chain conveyor hooks.

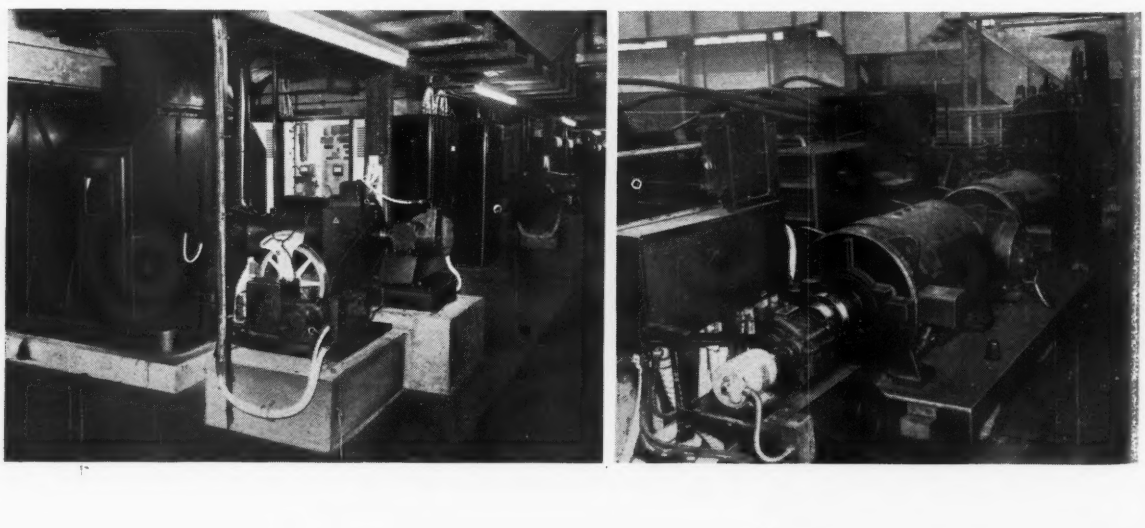
The chain conveyor is stopped automatically by a flag switch when the conveyor hooks are exactly opposite the loaders. The loaders are then operated, and having deposited the coils on the hooks, the conveyor is re-started by hand control and travels forward a certain distance. This distance is determined by the operator and is set so that when the conveyor is stopped again by the flag switch, empty hooks on the conveyor are presented opposite the loaders, ready for the next loading of coils.

After the coils have cooled during their journey on the conveyor, they are unloaded at a certain point on the route by the off-loader. The conveyor is not stopped for unloading purposes and each time a coil passes in front of the off-loader, this drive is automatically started, being initiated by means of a flag switch, and the coil is pushed off the hook on to the arm of the receiving stand. When one arm of the receiving stand becomes full, the stand is rotated through 90 deg and an empty arm is presented to the off-loader. The coils are unloaded by crane.

All automatic drives associated with the coilers and coil handling equipment are provided with alternative hand control by master switch. All drives with the exception of the coil off-loader and receiving stand are controlled from a desk situated in a pulpit overlooking the coilers. A small desk is mounted near the coil off-loader to control this drive and the receiving stand.

The Ward-Leonard d.c. contactor board for the coiler motors is situated in an annexe to the motor room and the constant voltage d.c. contactor board for all the other drives is in the motor room basement.

Left: Control gear for the flying shear with guard of electronic disc unit removed and control panel door open. Right: Flying shear drive



Sealed Transformers

Prevention of Oil Oxidation

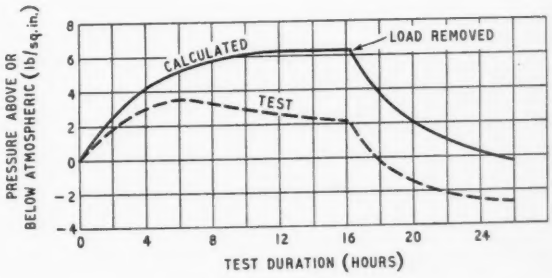
METHODS of preventing oxidation of transformer oil by sealing it from the atmosphere were considered in a paper presented on 26th January at a meeting of the Supply Section of the Institution of Electrical Engineers by Mr. E. B. Franklin (Compagnie Générale d'Electricité, formerly with the English Electric Co.). The author's calculations related to transformers of normal construction which were sealed and provided with expansion spaces (which might be initially filled with air or nitrogen) that were large enough to limit the gas pressure to a suitable value.

Pressures set up on load by the expansion of the oil differed from those determined by simple relations of volume and temperature owing to absorption of the gas, which also sometimes reacted chemically. Temperature affected solubility only slightly, but was the most important factor in the time taken by oxygen in solution to disappear in chemical reaction with the oil.

Oil in sealed transformers, unlike those in which breathing occurred, was subject to variations in pressure and in amounts of gases in solution. With temperature rise the partial pressure of gases above the oil increased and these passed into solution; at full load temperature the pressures of gases above the oil and in solution might be nearly equal. As the oil temperature was lowered the partial pressures of gases above the oil were reduced, but those of gases in solution might change only very slightly, since they were not readily released. The total pressure of gases in solution might then be several lb/sq in above atmospheric pressure and that of gases above the oil several lb/sq in below.

There was pressing need for further investigations into breakdown strength of oil under pressure in the latter conditions. One theory was that bubbles of gas in suspension, which became ionized in the field, initiated breakdown. It was also thought that the gas was changed from solution to suspension form by electric stress. The assumption was, therefore, that breakdown would occur if pressure affected the availability of gas in suspended form.

Large negative pressures could occur in sealed transformers which would seriously reduce the dielectric strength of the oil through causing air leakage into the transformer. This could theoretically be avoided by sealing the transformer initially under pressure, but to do so would increase the maximum possible pressure at full load. It became more practicable when nitrogen was employed. Valves limiting the minimum and maximum pressures were fitted by some manufacturers.



Calculated and test pressures in gas-solution process

Filling transformers under vacuum caused the oil to become gas deficient, tending to create large negative pressures. This tendency could be corrected by exposing a large area of the oil to air or, preferably, nitrogen at atmospheric or higher pressure before sealing, but this procedure was not effective for large transformers, except perhaps over extremely long periods of exposure. If the gas space was directly above the main body of oil, gas would go into solution under pressure in large quantities even before peak temperature was reached in a first heat run. This was demonstrated in the diagram here reproduced.

If the whole of the oil was to be eventually involved in the gas-solution process, the latter might well be hastened so as to relieve the maximum pressure, except where a low-pressure valve was fitted. An expansion vessel would increase the static head of oil at any point within the main tank. In large transformers with separate cooling banks the static head acting on the highest level in the main tank might reach 4lb/sq in, thus alleviating conditions leading to reduced electric strength.

Expanding Appliance Sales

THE January *Bulletin for Industry*, prepared by the Information Division of the Treasury, reviews retail sales during 1954 and makes particular reference to "domestic durables," e.g., hardware, radio and electrical goods.

Among other things the *Bulletin* says that the home laundry is becoming mechanized. About 100,000 hand-operated washing machines reached the home market in 1948; last year's annual rate was 14,000. Home deliveries of wringers and mangles have fallen too, but not as sharply; in 1948 supplies were 655,000, last year they were running at 430,000. Electric washing machines, on the other hand, were going into homes in 1948 at the rate of 93,000 a year, whereas in 1954 the figure was around a half million. The refrigerator is fast ceasing to be a domestic rarity: in 1948 about 115,000 reached the home market, while last year's deliveries were running at nearly double this figure.

The export experience of the domestic durables group of trades varies widely. Whereas the exports of television sets are negligible, a considerable, though falling, proportion of radio set output goes overseas. Most of the output of electric floor polishers is exported; so are more than half of the electric shavers and refrigerators, and about a third of the electric washing machines. There is a small export trade in electric cookers, but virtually none in gas cookers.

The boom in consumer durables, says the *Bulletin*, has made an important contribution to this year's rise in industrial production. The most impressive production rises over the past few years have been in electrical equipment—floor polishers, cookers and television sets. The further prospect is a good one. Consumer durables are among the most important indices of living standards, at home and abroad. Taken as a whole the industry is primarily dependent on the home market, but exports are not unimportant. In future years rising living standards in this country should lead to increased sales in the home market and abroad. There should be new opportunities for exports.

Miniature Circuit-Breakers

I.E.E. Discussion

THE discussion on the paper on "Design, Performance and Application of Miniature Circuit-Breakers" at the Institution of Electrical Engineers (*Electrical Review*, 27th January) was opened by Mr. H. W. Swann (Chilton Electric Products) who expressed surprise that there had been so little development of miniature circuit-breakers in this country since he first saw them in 1925. With an eye to the future, rupturing capacities higher than 1 MVA would be advisable. I.E.E. Wiring Regulation 611 tended to rob the circuit-breaker of its inherent ability to afford closer control of overload and might be amended.

Mr. E. Jacks (English Electric Co.) thought it an overstatement to imply that miniature circuit-breakers were of universal application for distribution in America where they had by no means ousted fuses. The standard fuse adopted in America forty years ago had made little advance, whereas this country had pioneered the h.r.c. fuse which in its present form was a peculiarly British development. The two types of device should be regarded as complementary.

Dr. H. D. Einhorn (University, Cape Town) said that miniature circuit-breakers were being installed in increasing numbers in South Africa. The most popular type was locally made of an American pattern with a rupturing capacity of about 5,000 A at 230 V. The proposal to back up miniature circuit-breakers by h.r.c. fuses seemed to be sound, but a faster breaker or a slower fuse was required than those tested in South Africa. The fuse should stand short-circuit currents of 2,000 A for at least 0·01 sec and must have a low enough long-time current to protect mains cables usually rated at about 50 to 150 A. The alternative was the exclusive use of circuit-breakers, and any manufacturer who could offer oil circuit-breaker performance at miniature circuit-breaker prices would have a flourishing export market.

Mr. S. Flax stated that the industrial triple-pole circuit-breaker had been developed to the same extent as the single-pole miniature circuit-breaker. It had been used for machine tools, printing machinery and so on for at least twenty years and to protect hand-held coal-drilling machines. Earth leakage protection was easily applied to triple-pole circuit-breakers, more recently of the core-balance type.

Saving in Maintenance

Mr. J. A. Robbins (Chilton Electric Products) referred to the saving in size of cable and in weight and size of board installation. Saving in maintenance with miniature circuit-breakers, it was hoped, would offset the initial outlay. Core-balance or earth-leakage protection could be combined with the m.c.b. Compared with fuses, its superior overload characteristics together with shock and fire risk protection could be combined in one relatively small unit. M.c.b.'s also allowed greater flexibility in application, by, for instance, incorporating under-voltage release, by tripping the breaker from a relay circuit or a remote button, or by incorporating auxiliary contacts—features not associated normally with switch fuses.

Mr. M. T. Reece (E.R.A.) thought the performances quoted in the paper might well be improved by slight changes in design of arc chutes and arcing horns. He asked how miniature circuit-breakers behaved on medium d.c. currents and questioned whether the arc was hotter and more destructive with carbon arcing tips.

Mr. E. W. Siemens (Nalder Bros. & Thompson) had no doubt that saving in maintenance costs would outweigh initial costs. Loss of production due to time taken in fuse replacement could be very costly.

Mr. H. W. Baxter pointed out that as the prospective current was increased, the energy to be dealt with went up and that it would be difficult to use m.c.b.'s where the short-circuit current was greater than 1,000 A.

Mr. R. A. Marryat asked whether an ordinary choke could not be installed in series with the installation so as to reduce the prospective short-circuit current to a figure with which the m.c.b. could cope. In small houses, for instance, it would probably not be a serious disadvantage.

Mr. Forbes Jackson held that there was a clear sphere for the m.c.b. by virtue of its ability to do many things—earth leakage and core balance protection, indicator lamps and so on as well as acting as a circuit-breaker, but doubted whether it could compete economically with the fuse in domestic premises. In large industrial and even commercial installations, however, production might be stopped while a fuse was replaced.

Mr. A. Hawes said that reliable protection and quick indication were of the utmost importance for d.c. applications. Thus a train could be delayed for thirty minutes by a blown fuse which could not be found quickly.

Mr. L. Gosland (E.R.A.) asked what proportions of his time an electrician spent in replacing a fuse or reclosing a circuit-breaker and in tracing and rectifying the fault.

In our summary of the paper last week, Mr. Wolff's company was incorrectly described as M.C.R. Co. (Manchester), Ltd. Mr. Wolff is managing director of the new company, M.C.B. Co. (Manchester), Ltd.

I.E.E. Functions

THE Council of the Institution of Electrical Engineers has accepted an invitation from the chairman and Committee of the Scottish Centre to hold the Summer Meeting of the Institution in Scotland from Monday, 6th June, to Saturday, 11th June. The headquarters will be in Inverness. Visits will be paid on the Tuesday to the Loch Sloy hydro-electric power station, the power station of the Lochaber Power Company and the works of the North British Aluminium Co., Ltd., at Fort William. During Wednesday, Thursday and Friday the programme will include visits to the North of Scotland Board's projects at Glen Garry and Glen Morriston, at Glen Affric and in the Conon Valley; Resistance Welders, Ltd.; local industries including a distillery and mills making homespun tweeds and knitwear; and scenic tours including an excursion to the Isle of Skye. On the last day, Saturday, the party will travel from Inverness to Edinburgh and visit *en route* the completed hydro-electric scheme at Pitlochry, which was seen under construction during the 1949 Scottish Summer Meeting.

The Supply Section Committee has decided to return to the pre-war custom of arranging from time to time a summer visit to take place on the Continent, and arrangements are now being made for the Section to visit Holland from 8th to 12th September next. It is hoped that this venture will be well supported by members of the Section and their ladies.

Travel both ways to and from Holland will be made overnight via Harwich and the Hook of Holland. The following programme has been arranged through the kind co-operation of the Koninklijk Instituut van Ingenieurs, and N. V. Nederlandsche Spoorwegen. Visits will be made to the KEMA Laboratories at Arnhem, the "Garden of Remembrance," "Hoge Veluwe" (a national park in which there is a memorial building containing a number of Van Gogh's paintings), and to Schiphol Airport. A water-bus tour on Amsterdam's canals and a visit to Rijks museum (containing a world-famous collection of Dutch paintings) will also be made.

OVERSEAS ELECTRICAL TRADE

Exports Recover in December After Dock Strike

FOLLOWING the sharp fall in November caused by the dock strike, exports of British electrical manufactures rose in December to one of the highest monthly values ever reached. This was, of course, largely the result of clearing the equipment held up in the docks and it is reasonable to assume that, but for the fact that last month's working time was shortened by the Christmas holidays, the reduction would have been wholly made good. As it was, the average for the last quarter of the year fell short of that for the first nine months.

For the whole twelve months the total value of exports classified in the Board of Trade returns under the heading of "Electric Machinery, Apparatus and Appliances"—£170·14 million—was 1·4 per cent below the 1953 amount and 5·8 per cent under the 1952 peak level. Details of the exports are given in Table I, comparative values of the main categories of electrical exports during the last three years being as follows:—

	1952	1953	1954
		£ (million)	
Generators and motors	30·44	29·40	30·51
Transformers, switchgear, etc.	27·22	29·90	26·95
Radio, television, etc., apparatus	22·99	23·26	25·99
Telegraph and telephone apparatus	16·46	16·58	15·13
Wires and cables	32·17	29·63	19·39

It will be seen that exports of generators and motors were actually a little better than in 1952, while those of radio and allied apparatus were substantially greater. The main reduction was in trade in wires and cables, exports of which were a third less than in 1953. The most important factor in this case was the falling off in exports to India from just over £5 million in both 1952 and 1953 to £2,705,356 last year. Purchases by South Africa decreased from £2,676,597 in 1953 to £1,393,067 last

TABLE I.—ELECTRICAL EXPORTS

Class	December 1954	Year 1953	Year 1954
	£	£	£
Generating sets and generators:			
Diesel-driven, up to 10 kW	127,757	1,096,722	1,227,637
Ditto, 10 to 65 kW	123,522	1,646,441	1,755,191
Ditto, 65 to 200 kW	62,055	1,135,544	939,824
Ditto, over 200 kW	662,823	1,777,657	4,140,332
Spark ignition engine driven	14,450	332,396	191,868
Steam turbine driven	170,678	1,751,761	1,221,795
Other prime mover driven	48,038	577,853	1,142,120
Generators	293,321	2,958,473	2,346,495
Parts of generators	378,626	5,444,263	4,833,080
Motors, complete, other than railway, tramway and trolley-bus:			
Up to ½ h.p.	219,728	1,627,471	2,198,628
Over ½ h.p. but under 1 h.p.	65,247	439,846	633,602
1 h.p. to 250 h.p.	444,477	4,758,121	4,528,909
Over 250 h.p	81,488	959,352	1,376,288
Railway, tramway and trolley-bus motors complete and parts of all motors	253,971	2,088,823	1,687,925
Motor starting and controlling gear	273,113	2,801,454	2,293,167
	3,219,294	29,396,177	30,516,661
Converting machinery	24,171	442,401	331,757
Mercury-arc rectifiers	96,160	797,661	634,362
Transformers for lighting, heating and power (incl. coils)	911,047	12,519,795	10,764,746
Switchgear and switchboards (not telegraph or telephone)	1,368,913	16,145,141	15,221,693
	2,400,291	29,904,998	26,952,558
Primary batteries:			
Lighting	77,148	702,552	791,201
Radio	186,248	1,044,962	1,776,247
Other	51,220	503,274	530,367
Parts (excl. carbons)	51,874	330,574	596,843
Lamps:			
Filament, exceeding 24 V	108,503	822,205	924,345
Ditto, under 24 V	37,062	262,866	362,812
Discharge lamps, fluorescent tubes, etc.	76,832	537,119	700,372
Other lamps	11,748	157,289	249,258
Radio and television, etc., apparatus:			
Cathode-ray tubes	17,895	152,716	140,124
Other valves (not X-ray)	229,119	2,047,048	1,973,096
Radio and television transmitters	102,797	929,732	676,520
Commercial radio and radar equipment	810,882	10,119,593	11,719,626
Domestic radio receivers, mains	223,469	2,340,104	1,923,416
Ditto, battery	89,570	526,972	651,337
Ditto, other (incl. car)	29,222	163,061	170,070
Radiograms	46,468	483,312	433,111
Television sets	26,771	428,160	450,299
Public address equipment	74,180	590,945	719,045
Sound reproducing app., n.e.s.	39,369	175,973	289,328
Components and parts, n.e.s., incl. parts of valves and c.r. tubes	772,633	5,298,396	6,846,330
	2,462,375	23,256,012	25,992,302
Telegraph and telephone installations	907,556	5,203,816	7,022,783
Telephone instruments, separately consigned	81,798	1,739,782	1,169,369
Telegraph and telephone parts	558,519	7,347,872	5,412,346
Line apparatus for long distance commun.	125,388	2,289,526	1,526,738
	1,673,261	16,580,996	15,131,236

Class	December 1954	Year 1953	Year 1954
	£	£	£
Cookers	111,672	544,659	1,000,262
Toasters	28,138	215,965	252,747
Other cooking apparatus	40,019	247,111	407,008
Parts and accessories	78,356	352,021	567,558
Space heating appliances	48,293	246,897	415,627
Water heating appliances	34,278	293,301	298,378
Other heating appliances	29,954	280,511	362,785
Parts and accessories	73,561	524,017	611,813
Irons	123,666	652,813	825,067
Arc welding equipment, a.c.	23,827	504,134	376,237
Ditto, d.c.	53,079	481,447	535,596
Resistance welding equipment	17,626	149,862	187,955
Magnetos, ignition	15,879	227,740	164,641
Sparking plugs	193,958	1,410,037	1,727,395
Elec. appliances for aeroplanes, n.e.s.	180,849	1,934,289	2,084,554
Ditto, for motor vehicles, n.e.s.	359,902	2,147,743	2,946,754
Ditto, for cycles, n.e.s.	37,481	794,835	838,011
Signalling app. (incl. traffic signals)	39,650	767,108	584,870
Industrial radio-frequency equipment	27,733	178,109	258,982
Bell app. (not telegraphic or telephonic)	13,270	91,129	101,896
Instruments, commercial	174,185	1,722,434	1,755,249
House service meters (not prepayment)	132,913	1,000,478	1,340,072
Ditto, prepayment, and parts of all house service meters	26,960	110,774	180,367
Electro-medical apparatus (not X-ray)	51,644	478,877	533,729
X-ray apparatus (excl. tubes and valves)	72,454	742,093	579,078
Vacuum tubes	22,572	241,121	215,343
Desk fans	20,659	341,190	358,789
Ceiling fans	66,189	1,130,827	1,009,161
Vacuum cleaners	204,143	1,499,881	2,031,716
Floor polishers	99,691	704,308	1,165,235
Food mixers	71,186	528,315	629,066
Hair clippers and dry shavers	122,919	517,808	1,238,570
Other portable appliances	74,006	204,996	373,720
Parts	104,971	520,458	900,368
Portable elec. tools (not saws) and parts	211,487	1,714,082	1,913,464
Cables and wires:			
Telegraph and telephone, submarine	27,708	920,739	759,469
Ditto, other	433,748	7,866,495	3,812,028
Cotton, silk or art. silk insulated	44,168	665,003	438,576
Enamel, glass or asbestos insulated	117,768	975,589	874,046
Paper insulated	703,339	11,070,816	6,120,951
Rubber insulated	493,162	5,005,375	4,649,280
Other	262,705	3,126,015	2,737,650
	2,082,598	29,630,032	19,392,000
Accumulators for motor vehicles	136,932	1,746,464	1,742,586
Ditto, traction	15,801	216,161	272,463
Ditto, radio and other portable	148,328	559,179	689,601
Ditto, other	24,907	585,320	491,969
Parts and accessories	83,133	605,374	732,015
Elec. porcelain, etc. (incl. insulators)	100,137	934,568	938,212
Insulating cloth and tape	80,979	545,466	622,739
Other insulating material	96,804	761,558	904,794
Permanent magnets	64,942	408,330	513,599
Radio, telegraph and telephone testing equipment, n.e.s.	61,852	314,265	419,318
Scientific elec. instruments (not telegraphic or telephonic)	312,866	1,773,301	2,603,921
Electrical machinery, n.e.s.	118,884	973,409	1,517,129
Electrical apparatus and appliances, n.e.s.	556,910	6,521,938	5,975,905
TOTAL	17,228,099	172,575,759	170,142,716

TABLE II.—DISTRIBUTION OF EXPORTS OF ELECTRICAL MACHINERY, APPARATUS AND APPLIANCES

Country	December, 1954	Year ended 31st December 1952	1953	1954	Country	December, 1954	Year ended 31st December 1952	1953	1954
	£	£	£	£		£	£	£	£
Channel Islands	60,605	506,119	475,803	663,457	Belgium	224,086	2,605,028	3,493,858	2,979,923
Gibraltar	14,009	293,776	220,998	192,585	France	246,501	1,679,918	3,096,830	3,148,423
Malta and Gozo	145,825	197,682	322,912	634,349	Switzerland	126,174	941,664	849,403	1,065,699
Cyprus	100,851	682,159	605,509	771,601	Portugal	117,695	1,556,544	1,683,162	2,032,941
Sierra Leone	18,911	183,222	346,472	265,381	Spain	169,241	2,644,152	2,920,889	2,800,179
Gold Coast	99,613	1,145,326	1,193,149	1,256,345	Italy	225,462	1,591,976	2,362,433	2,673,045
Nigeria	225,922	1,889,534	2,256,824	1,837,814	Austria	20,527	477,349	684,230	602,596
Union of South Africa ...	1,844,033	18,628,224	19,838,186	17,988,209	Czechoslovakia	15,345	156,716	78,210	46,845
Northern Rhodesia	100,158	1,880,987	1,372,015	1,374,948	Yugoslavia	51,452	719,326	663,958	1,040,928
Southern Rhodesia	254,222	3,287,425	2,534,536	2,372,150	Greece	118,477	1,485,120	912,668	907,286
Tanganyika	39,111	872,465	613,553	617,939	Roumania	14,903	446,497	1,077,393	42,281
Kenya	117,744	2,588,131	2,711,976	1,689,994	Netherlands Antilles	91,233	2,800,008	1,076,976	621,725
Uganda	17,972	535,568	848,999	647,245	Belgian Congo	9,623	225,327	147,416	79,864
Nyasaland	8,021	198,356	141,989	107,850	French Morocco	29,287	*	276,916	280,021
Mauritius	22,400	260,243	277,983	221,488	Angola	11,936	155,329	134,677	123,197
Aden	41,363	446,635	1,710,392	830,748	Portuguese East Africa ...	26,739	304,174	250,596	247,332
Bahrain, Qatar and T. Oman...	108,202	571,356	1,047,308	1,294,034	Syria	49,437	284,819	297,038	329,604
Kuwait	138,575	924,154	1,675,203	1,356,051	Lebanon	29,160	655,587	390,572	357,561
India	1,288,377	17,137,785	18,029,027	14,835,778	Israel	45,420	688,071	660,773	364,427
Pakistan	379,381	4,010,561	3,597,106	4,831,139	Jordan	48,760	280,320	297,735	249,827
Singapore	252,798	3,813,144	2,887,825	3,136,312	Egypt	192,470	2,520,193	1,266,005	1,199,493
Federation of Malaya	231,969	2,900,166	2,882,382	2,527,386	Libya	24,205	243,314	206,058	113,852
Ceylon	152,529	1,701,120	1,826,676	1,375,657	Saudi Arabia	36,022	457,332	500,114	569,244
British North Borneo ...	13,331	171,936	347,115	389,625	Iraq	177,624	1,981,803	2,368,344	2,463,338
Hong Kong	204,499	2,514,395	2,205,984	1,802,267	Iran	36,509	257,179	223,780	388,790
Australia	1,915,207	21,942,987	17,087,387	17,487,101	Burma	120,242	1,040,171	1,294,898	1,605,652
New Zealand	1,033,381	10,785,156	9,678,592	9,844,641	Thailand	137,020	1,121,319	1,425,039	1,829,240
Canada	794,248	7,739,091	8,514,261	8,255,536	Indonesia	132,812	1,313,223	781,835	563,432
Jamaica	84,888	777,954	744,442	758,751	Japan	48,831	266,689	808,670	730,032
Barbados	23,353	198,838	163,926	229,831	United States of America ...	251,729	1,951,457	2,387,824	2,697,076
Trinidad	160,525	831,876	958,768	983,990	Cuba	23,033	404,768	202,166	207,288
British Guiana	46,862	307,665	350,300	398,341	Mexico	43,271	583,800	347,008	370,189
Anglo-Egyptian Sudan ...	170,416	1,044,489	1,173,338	1,112,891	Colombia	115,551	924,458	606,671	1,106,571
Other C'wealth countries ...	131,667	1,228,386	1,505,081	1,360,206	Venezuela	329,092	1,431,687	1,845,196	2,118,686
Irish Republic	357,774	5,051,562	3,331,497	3,321,969	Peru	34,944	495,786	439,676	348,792
Soviet Union	478,839	872,463	1,299,552	2,390,243	Chile	106,405	780,071	446,780	433,884
Finland	122,019	1,856,475	807,347	1,312,331	Brazil	225,924	4,043,206	1,189,601	879,799
Sweden	457,820	4,944,391	4,167,016	4,264,572	Uruguay	63,277	478,807	401,322	758,138
Norway	241,851	3,044,501	3,131,823	3,103,358	Argentine Republic	187,749	1,651,463	983,964	1,022,210
Iceland	27,856	216,244	221,047	203,986	Other foreign countries ...	260,506	1,650,003	1,673,810	1,768,237
Denmark	170,006	1,500,215	1,295,474	1,947,454	TOTAL	17,228,099	180,500,347	172,575,759	170,142,716
Poland	8,844	935,418	1,008,599	582,018					
Western Germany	186,331	969,651	965,504	1,579,171					
Netherlands	687,735	5,212,907	5,070,930	6,506,258					

* Not separately distinguished.

year and by Australia from £2,300,938 to £1,391,298. Many foreign countries also took less, notably Roumania (£38,638 last year against £1,056,074 in 1953), one exception being Colombia (£438,618 against £107,580).

Australia was the chief importer of British generating plant and motors, taking equipment to the value of £3,390,197 (against £3,547,878 in 1953), followed by South Africa, £3,087,047 (£3,368,439), India, £2,233,202 (£2,701,251), the Soviet Union, £1,821,741 (£177,664), Canada, £1,797,744 (£2,297,844), the Netherlands, £1,236,873 (£1,079,295), Spain, £1,179,299 (£915,338) and Thailand, £1,105,673 (£670,533).

Rather surprisingly, the Netherlands was the leading buyer of radio apparatus made in this country, with a total of £2,213,469 (against £1,394,201), followed by Canada and Sweden. Canada's purchases last year, at £1,784,747, compared with £1,007,320 in 1953 and £830,741 in 1952.

Domestic appliance manufacturers had a good year, exports of electrical cooking appliances rising from £1,359,756 to £2,227,575; heating appliances from

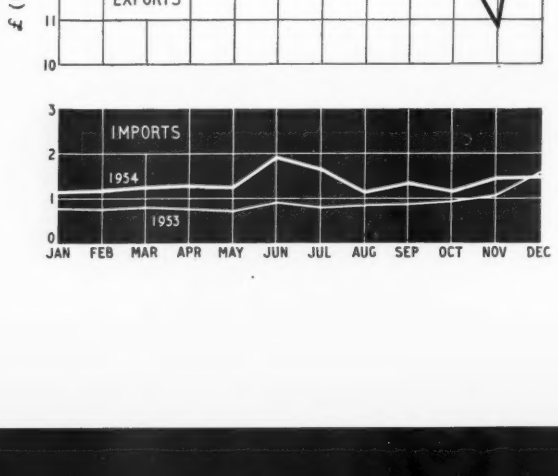


TABLE III.—OTHER ELECTRICAL EXPORTS

Class	December 1954	Year 1953	Year 1954
	£	£	£
Washing machines, electrically operated:			
Not exceeding 150 lb weight	235,135	2,945,073	2,944,597
Over 150 lb	189,015	1,208,010	1,612,821
Parts	58,582	461,302	603,029
Electric conduit tubes and cased tubes ...	61,375	903,231	788,439
Welding electrodes:			
Ferrous	92,536	943,888	830,076
Non-ferrous	33,320	383,290	276,868
Electric locomotives	78,669	4,327,958	1,898,417
Diesel locomotives with electrical transmission	274,081	748,823	4,139,747
Electric lighting appliances (excluding vacuum tubes and lamp bulbs), accessories and fittings, and parts n.e.s. ...	507,526	4,886,701	4,702,007

£1,344,726 to £1,688,603; electric irons from £652,813 to £825,067; vacuum cleaners from £1,499,881 to £2,031,716; floor polishers from £704,308 to £1,165,235; and food mixers from £528,315 to £629,066, while overseas sales of hair clippers and dry shavers were worth more than twice as much as in 1953 (£1,238,570 against £517,808).

Table II analyses the destinations of all exports included in Table I and the accompanying diagram shows the comparative trends each month in 1953 and 1954. In addition to the equipment included in this survey a number of electrical products are listed in other sections of the official returns and some of the more important of these are set out in Table III.

Considerably more electrical equipment was imported last year, principally radio apparatus—which accounted for just about half of the total of nearly £16 million. Aircraft,

TABLE IV.—ELECTRICAL IMPORTS

Class	1953	1954
	£	£
Generators, including parts	389,847	880,631
Motors, including parts	599,401	370,105
Convertors, mercury arc rectifiers, transformers, switchgear and switchboards (not telegraph or telephone)	443,683	710,983
Valves, electronic, excluding X-ray valves (whether separately consigned or with apparatus of which they form a part), complete	872,395	1,687,103
Cathode ray tubes, complete	1,078,985	1,640,773
Radio communication and navigational aid equipment (including radar), complete	1,632,570	1,655,410
Other apparatus for telegraphy, telephony, radio, television and radar, including components and parts n.e.s. and parts of electronic valves and c.r. tubes	1,500,020	2,970,283
Welding machinery other than tube-making (not electrodes)	274,610	162,925
Magnetos, ignition, and electric appliances for aeroplanes, motor vehicles and cycles	543,621	1,251,297
Electro-medical apparatus (including X-ray apparatus, tubes and valves)	390,275	501,864
Electric cables, wires, strips and strands, insulated	97,509	189,779
Scientific electrical instruments (not telegraphic or telephonic)	578,357	690,472
Electrical machinery and appliances n.e.s.	2,053,271	3,272,273
Country		
Canada	1,016,396	1,706,738
Other Commonwealth countries	867,888	1,317,562
Irish Republic	290,968	473,051
Sweden	282,006	565,207
Denmark	226,567	250,169
Western Germany	1,130,497	1,896,680
Netherlands	2,905,087	4,748,373
Belgium	196,351	282,810
France	439,905	583,280
Switzerland	396,768	673,296
Italy	236,763	164,493
United States of America	2,078,720	2,663,850
Other foreign countries	386,628	658,389
TOTAL	10,454,544	15,983,898

motor vehicle and cycle electrical equipment imports also rose appreciably from £543,621 to £1,251,297. As will be seen (Table IV) the Netherlands was the chief supplier of electrical equipment imported into this country, followed by the United States and Western Germany.

Electrification of Cyprus

WE have received from Mr. J. O. Hall, O.B.E., the general manager and chief engineer, a copy of the second annual report of the Electricity Authority of Cyprus, covering the year ended 31st December, 1953. The Authority, whose chairman is Mr. H. F. Carpenter, C.B.E., formerly secretary of the British Electricity Authority, is engaged upon a comprehensive electrification scheme. The report refers to the rapid growth of the demand for supplies and says that every effort will be made to expedite the works envisaged in the second stage of the scheme.

During the year under review the Authority acquired the municipal undertakings at Famagusta, Larnaca, Morphou and Kyrenia and at the close of the year five of the six principal towns in the island were being supplied from the Dekhelia generating station. This station went on commercial load on 2nd February, 1953, supplying electricity to Nicosia, and with the commissioning of further plant during the year Limassol and the four acquired undertakings mentioned above were also served. A total of 23·1 million kWh was generated at Dekhelia out of the 26·7 million kWh from all stations operated by the Authority; the latter figure compares with the 18·7 million kWh generated in 1952, representing an increase of 43 per cent. Sales amounted to 20·3 million kWh. At the end of the year there were 31,402 consumers, an increase of 11,533, of whom 9,146 were transferred with the acquired undertakings.

Good progress was made in extending the transmission and distribution networks. At the beginning of the year there existed 91 miles of 66 kV transmission lines, all except three miles being of "H" type wood pole construction. In 1953 a further 67 miles of line of this rating was erected, 23½ miles in the mountain section being on single circuit steel towers and the remainder on "H" type wood poles. This completed the programme of 66 kV transmission line construction under Stage 1 of the electrification scheme. In addition, the 11 kV distribution system was extended by 36 miles of overhead lines and approximately 10 miles of underground cables. Low voltage extensions comprised 27 miles of overhead lines and about a mile of underground cable.

The Authority's accounts for the year show a revenue of £370,274 with a gross profit of £86,266. After deducting interest charges, etc., there was a deficit of £79,264. Commenting on this, the report explains that the undertaking is in the development stage and large capital expenditure has been incurred. This stage is expected to last for several years.

Following a report by Mr. F. C. Fenton, new tariffs were introduced in May, 1953, and later other rates were approved for heating and cooking, street lighting, and off-peak supplies for water pumping for irrigation purposes.

N.S.W. Power Supplies

THE first power from the Snowy Mountains Scheme will be distributed by the New South Wales Electricity Commission this year. The chairman of the Commission, Mr. H. G. Conde, announcing this, said that new hydro-electric power stations were also being developed in conjunction with the Hume and Warragamba dams and new sources of power were being investigated. However, for the foreseeable future New South Wales would be basically dependent for its power on thermal stations burning coal.

Mr. Conde said that the Commission had added 133 MW to the N.S.W. interconnected system during 1954; it expected to add a further 100 MW this year and twice as much in 1956. The new power units brought into production in 1954 were 50 MW at Pyrmont station, the first 30 MW at the new Tallawarra station on Lake Illawarra, 25 MW at Balmain, 16 MW at Port Kembla and 12 MW at Liverpool. The increase was necessary because the demand for power in N.S.W. was increasing at the rate of 10 per cent a year. Since the Commission was formed 4½ years ago it had doubled the State's power output.

LETTERS TO THE EDITOR

Letters should bear the writers' names and addresses, not necessarily for publication. Responsibility cannot be accepted for the opinions expressed by correspondents.

Shortage of Technologists

YOUR correspondent " D.J.C." compares in the *Electrical Review* of 14th January the salary offered for a third assistant district engineer with the slightly higher figure for a showroom supervisor. No doubt, general sympathy, including that of the employers concerned, is with the technologist but I do not think that the right question is put in this perennial discussion, viz. which is the easier to get—a good showroom supervisor or a good technologist ?

It has at times been easier to find a good technologist, as such, than a good writer having sufficient technical background, because the technically qualified prefer on the whole to do their own field work and are not content to write about other people's. Perhaps there is, similarly, a shortage of good supervising salesmen with sufficient technical background: perhaps there is unwillingness here to spend one's days advising harassed housewives about resetting kettle cut-outs. Consequently I should like to see this subject approached from the employers' point of view so that both sides—commercial and technical—can see the whole picture.

It is also important that this matter be tackled for the right reason. That reason is the lack of recognition by both the commercial and the technical man of the fact that each has a technique, a responsibility—to the consumer, the industry, and the other man—and a place in the sun. It is of course easier to see this from the outside. Yet, if the fundamental problem had been tackled years ago (and in many other industries than the electrical) the salary question might not be with us now.

London, W.1. E. W. ROGERS,
Editor,
Aluminium Development Association.

THE letter from " D.J.C." shows a narrowness of outlook which I am afraid is all too common these days.

A showroom supervisor is the main contact between the public and the supply authority, and only a man of the highest calibre should be chosen for such a post. He should have engineering and commercial knowledge and experience, and above all, personality.

One could put up with second best for a third assistant engineer but *not* for a showroom supervisor.

St. Helier, Jersey. W. K. ALLEN,
Managing Director,
Jersey Electricity Co., Ltd.

YOUR correspondent " D.J.C." does not seem to approve " conditions " that enable a showroom supervisor (male) to receive remuneration in excess of that offered to a third assistant district engineer but does not take the trouble to try and justify his dogmatic statement. It might also be said that so long as such ill-considered opinions exist, efforts to maintain close harmony of relations between all sections of the supply industry will, to a large extent, be nullified.

Circumstances alter cases and comparisons are odious but your correspondent is careful not to provide sufficient facts on which readers might base a reasonable opinion. Is he aware that, depending on classification, a third assistant district engineer can be paid as little as £475 per annum, and does he feel that no showroom supervisor should be paid more, merely on a comparison of duties ?

I assume that your correspondent refers to the Lewes and Central Sussex Districts. If this is so he would be well advised to compare the size of the Districts. I am not familiar with either but there would seem to be more units sold in Central Sussex than in Lewes. To merely ask who sells these units would be to invite criticism of the kind I am making but surely the commercial staff plays a part in developing sales on which, ironically, engineers' salaries are based. The salary of the showroom supervisor is related to his responsibilities and the numbers of established staff he controls rather than to the units he helps to sell.

Would " D.J.C." have the showroom supervisor placed in penury for the benefit of the engineer, or is he suffering from the common malady of blindness to the fact that our industry is and always will be dependent upon the talents of all employees. He should remember that the showroom supervisor might also be a well-educated man and might also have taken considerable care to equip himself so that he too might be considered " well trained."

No doubt the recent news of increases in salaries to be made to N.J.C. employees will incense your correspondent still further.

Dewsbury, Yorks. E. ASQUITH, A.M.I.E.E.

Who Were the Makers?

A FEW weeks ago you very kindly published a letter from me asking your readers' help in identifying an early type of filament lamp which has been presented to the E.D.A. Museum.

I would like to thank the many readers who telephoned or wrote, giving us much information upon the subject. I think we can say without any doubt that the lamp in question was made by the Condor Company, a Dutch firm who marketed it under the trade name of " Sunlite."

The " spinning top " shape of bulb enabled the lamp to be fitted with either a close-fitting opal shade covering the upper half of the bulb or else a similarly shaped silvered reflector. Examples of these lamps and shades are still in existence apparently, which only goes to show how much of past history lies in storerooms and cupboards of electrical firms.

A number of readers have been kind enough to send us some very early examples of carbon filament lamps all in working order, including a 2½ c.p. lamp no bigger than a car headlight bulb. The E.D.A. Museum has already acquired a number of very interesting exhibits including one of the few Nernst lamps in existence which is in complete working order.

There have been so many changes in the design of domestic electrical appliances and accessories over the past fifty years that there is a danger of some of the most striking examples being completely lost to posterity. Where now, for instance, can be found one of the early " squirted " tungsten filament lamps or a tantalum lamp in working order ? The E.D.A. Museum has the first but not the second. Where, too, may be found such items as the Philips twin-light lamp, the carborundum fire ba-

and the Venner oil-filled grill ? Has any supply engineer an Aron clock-meter which was so popular in the early days of this century ? Where have all the little arc-lamps gone, which were widely used for shop lighting in the past ?

These relics of a bygone age are worth preserving and the E.D.A. Museum will take good care of any of them which are still available if any reader cares to send them to me. The donor's name will be recorded and published in every case.

London, W.C.2. JOHN M. FRASER,
Press Officer,
British Electrical Development Association.

The Engineer's Status

I WISH to refer to your recent editorial wherein you published some figures of the numbers of graduate engineers in Russia and the United States during 1954. These were taken from a statement made to the American Society of Mechanical Engineers and indicated that Russia was producing nearly three times as many engineers as the U.S.A. Your paragraph ended by suggesting that this country wasn't even in the race.

There have been many statements by responsible bodies and distinguished persons on this subject in recent years. They all confirm the shortage of engineers, scientists and technologists and bewail the fact that not enough people of the right calibre are entering courses of technical training. Not one that I can recall has mentioned the good old-fashioned law of supply and demand. In other words, if the rewards are sufficient to attract the right people they will be forthcoming.

The situation in Russia and the United States illustrates the position perfectly. It is well known that the engineer holds a highly esteemed and well rewarded position in the U.S.S.R. In the U.S.A., of course, commerce provides by far the richest reward and receives the greatest general acclaim. However, the technologist, engineer and scientist are probably the greatest and most admired professional group, their standard of living being commensurate with the leading part they play in the tremendous growth and flexibility of their economy.

In Great Britain, unfortunately, the engineer has always been regarded as a rather unpleasant though apparently necessary fellow who must be kept in his place and treated with a sort of good-humoured condescension. The position regarding salary and status has improved since the war but there are still many cases where a university graduate is paid £400 a year and an electrician's mate receives £12 a week.

To be an engineer has in the past and is still to-day rather a "labour of love." When the rewards become commensurate with the long, hard training and inherent integrity, then the shortage of technically qualified people at all levels will tend to correct itself naturally. It is, of course, essential that adequate training facilities be made available but the immediate need is for fewer platitudes and more action.

Belvedere, Kent. R. J. CAKEBREAD.

Earth Drilling

IN the matter of earth drilling, I should like to express a contrary opinion to that held by the contributor of the article on "Rural Distribution" in your issue of 31st December last.

In my opinion a light rig of the guided or suspended type gives adequate results only in light soil. For general use in all types of soil, excluding rock, a heavier machine with power feed is essential for satisfactory performance. This view is endorsed by a steadily increasing number of purchasers of a machine which I produce.

The manœuvrability of this machine has been greatly increased during the past four years, principally through re-design of the front axle, wheel and tyre equipment. The earlier model, however, was satisfactory. A three-year-old machine operating in the South of England is now well into its third thousand excavations and on the last job which comprised 175 h.v. and l.v. poles, it drilled and erected 96 per cent of the total. Up to date there has not been a single damage claim as a result of its operation.

Southsea, Hants. R. WOOLLEY,
Director and General Manager,
Lennox Motor Co., Ltd.

Manchester Catering Exhibition

MANY items of electrical equipment, including several that make their appearance for the first time, are to be seen at the Hotel and Catering Exhibition which opened at the City Hall, Manchester, last week and closes tomorrow (Saturday).

A comprehensive range of refrigerated display and storage cabinets is on show in the frozen food display section where Frigidaire exhibit the "Frostmaster" which can provide up to 15 per cent more usable space in existing refrigerated stores. On the stand of the Lightfoot Refrigeration Co., Ltd., the exhibits range from the 3ft domestic model to 15ft two-door commercial service cabinets. Bottle cooling cabinets shown include an open type bottled beverage cooler with two shelves and a capacity of 300 ½-pints. The Prestcold organization is represented, as also is Kelvinator, which exhibits the "Polarsphere" hermetically sealed condensing unit which is now available for certain commercial applications.

Hall & Rogers, Ltd., are showing for the first time the Gaggia "Espresso" coffee machine. Samples of the coffee produced are available and these provide a continual supply of "dirty" cups and saucers for the Staines "Splendid" crockery washing machines, which are being exhibited under typical working conditions on their adjacent stand. Demonstrations of the new "Ada-Maid" dishwashers are given by Ada (Halifax), Ltd., and catering type dishwashers are shown by Leonard Hall & Co. On the Hoover stand the "Glassmaster," which washes and sterilizes glasses at the rate of 1,500 per hour, is displayed, together with the complete range of the company's appliances, including washing machines, cleaners and polishers, and the "Steam-or-Dry" iron. Fillerys (Great Britain), Ltd., have introduced a new high-speed three-brush combined polisher and vacuum cleaner, model S.P.3, with which, it is claimed, pre-sweeping is unnecessary.

A new infra-red grill of British manufacture has made its appearance in the Apsley "Fastrayde," and it is claimed that steaks can now be cooked in less than a minute. Another novel appliance, also being shown for the first time, is the "Roto-Grill," an electrically operated rotary sausage grilling machine, manufactured by Taylor Stainless Metals, Ltd.

Designed particularly for the small and medium-sized catering establishment, the H.M.V. food mixer is extremely versatile and can be seen demonstrated on the company's stand. One of the more unusual stands is that occupied by Miller-Kent, where internally lighted artificial flowers, made from fireproof washable plastics, are arranged in tasteful displays.

Cast Steel Roll Production

A NEW APPLICATION OF THE ELECTRODE ARC FURNACE

WE recently witnessed a demonstration of an electrode arc furnace which has been installed at the extended works at Coatbridge, Glasgow, of R. B. Tennent, Ltd., for the production of the rolls associated with steel and other types of rolling mills. This new furnace installation, which is associated with a particularly well laid out and spacious new foundry, is the most recent of a series of major developments which have marked the progress of Tennent's since the establishment of the firm and its first small iron foundry in 1857 up to the present time when the company occupies a leading position in the British Roll Makers' Corporation.

In 1870 the works were transferred to the present site at Whifflet, Coatbridge, where a new foundry and machine shop equipped with two air furnaces and cupolas rendered possible the production of castings of much greater weight. At about this time the new methods of iron refining were being developed, steel largely replacing iron following the invention of the Siemens open hearth furnace in 1861, and later, in 1878, the discovery and application of the basic method of steel making by Thomas and Gilchrist. The erection of new steel works following these developments meant that more and heavier types of castings were required from the foundries and with their facilities for large tonnage Tennent's were employed continuously in meeting these demands, particularly for mill equipment.

Beginning in the "seventies" with rolls for the local iron works the manufacture of rolls soon became of increasing concern to Tennent's and by 1890 this work formed an important part of the total output. In 1879 the company purchased from Gontermann-Peipers their patented method of chilled roll moulding, and shortly afterwards began experiments in making large chilled rolls for the rolling of plates, and in 1889 an additional foundry with air furnaces was built for the production of chilled rolls.

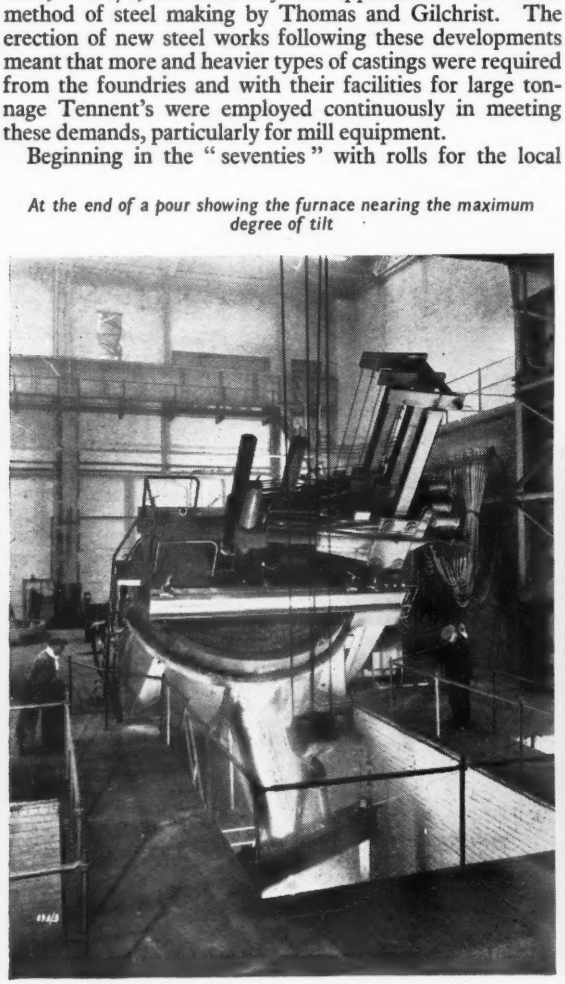
In 1900 the building of another and larger foundry began, and to-day this building is still the main foundry and is capable of handling the heaviest of roll castings. It is equipped with air furnaces with a combined capacity of 100 tons. And so progress continued with the demands for greater and greater outputs, and in 1948 a further programme of development and expansion was undertaken to meet the ever increasing demand for rolls throughout the world, which included the erection of new buildings for research, heat treatment, machining, moulding and casting.

By 1950 two additional buildings had been completed. The installation of oil fired heat treatment furnaces, heavy duty lathes and ancillary equipment was then undertaken, the majority of the tools being of Craven manufacture and incorporating the most up-to-date British designs in roll machining equipment with modern electric drives.

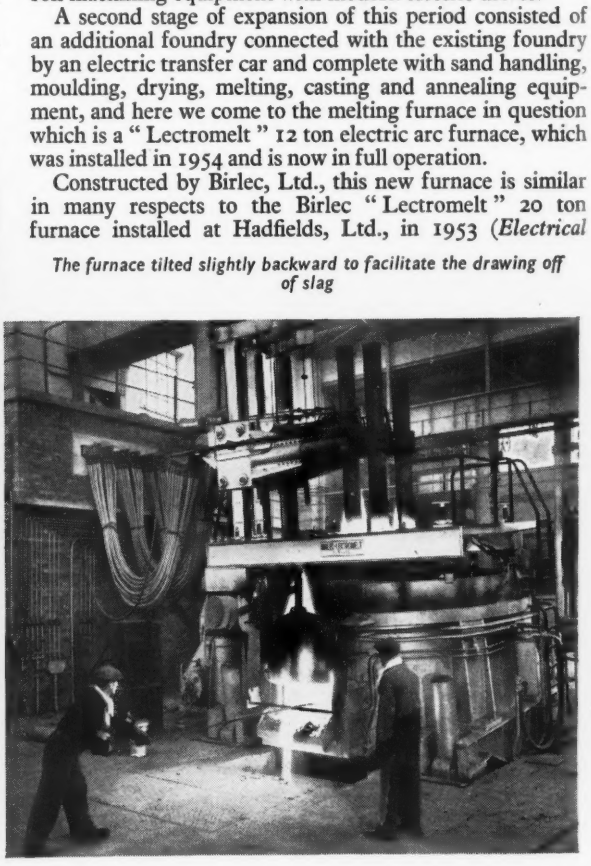
A second stage of expansion of this period consisted of an additional foundry connected with the existing foundry by an electric transfer car and complete with sand handling, moulding, drying, melting, casting and annealing equipment, and here we come to the melting furnace in question which is a "Lectromelt" 12 ton electric arc furnace, which was installed in 1954 and is now in full operation.

Constructed by Birlec, Ltd., this new furnace is similar in many respects to the Birlec "Lectromelt" 20 ton furnace installed at Hadfields, Ltd., in 1953 (*Electrical*

At the end of a pour showing the furnace nearing the maximum degree of tilt



The furnace tilted slightly backward to facilitate the drawing off of slag

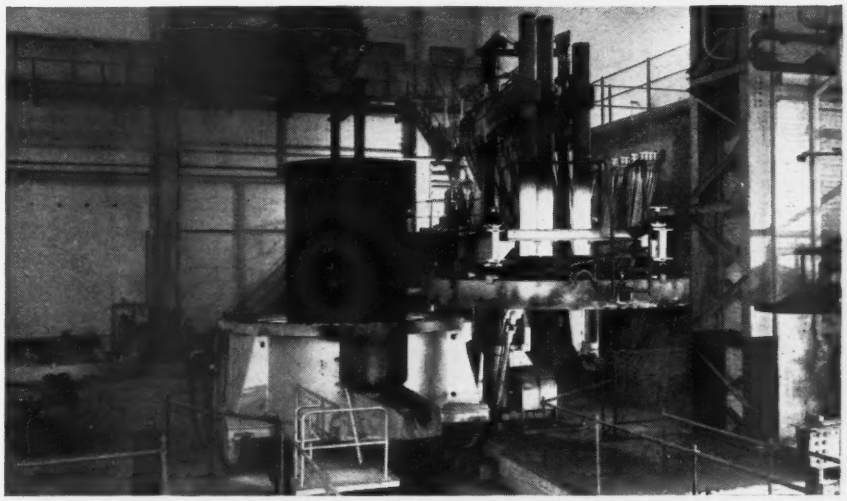


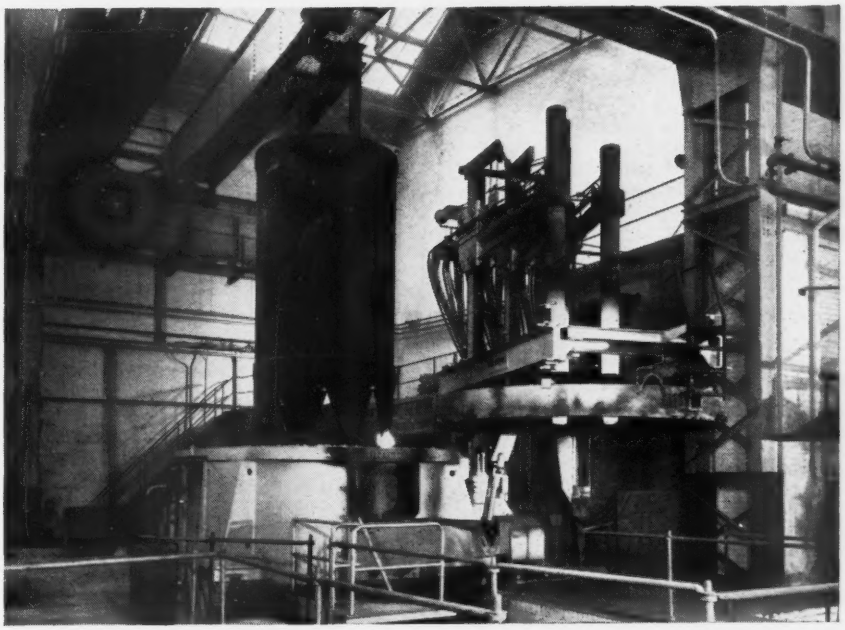
Review, 20th March, 1953) and the Birlec "Lectromelt" 60 ton furnace installed at Samuel Fox & Co., Ltd., in 1954 (*Electrical Review*, 17th December, 1954), but the following notes afford an outline description of the new installation.

The furnace has a diameter of 12ft and is constructed of heavy gauge steel plates lined with suitable refractory material. A top stiffening bezel ring, which is water cooled, is provided to prevent distortion under heat. For slagging, oxygen lancing, fettling and other operations there is a refractory-lined door let into the side. The pouring spout, which is also lined with refractory material, is attached to reinforcements on the shell. The roof refractories are supported on a water-cooled channel section ring which is suspended at four points on two structural steel beams, an arrangement which facilitates removal and replacement and obviates any trouble in aligning the electrode ports and electrodes. The roof structure has an eye attachment in which a vertical hydraulic ram engages to lift the roof clear of the furnace for top charging purposes.

When the roof is raised clear of the furnace body it is swung round through an angle of nearly 75 deg to expose the hearth. The furnace can then be loaded by lowering a drop bottom bucket into the shell. These operations are effected by interlocked mechanism to ensure that they take place in the correct sequence. Tilting is effected by a pair of rams, the oil pressure for which and for the roof raising mechanism is generated in a self-contained electrically-driven plant.

Power for operating the furnace is obtained from the





Top : General view of the furnace installation showing, on left, the control panel, transformer house and substation

Centre : Charging the furnace by overhead crane, showing the roof swung aside and the charging bucket in position

Bottom : Withdrawing the bucket after the charge has fallen on to the furnace hearth

public mains on the three-phase system at 11,000 kV through a metalclad switch supplied by A. Reyrolle & Co., Ltd., which controls the supply to a 4,000 kVA transformer of Electric Construction Co., Ltd. The three 10in diameter electrodes are secured in water-cooled copper clamps and project vertically through the furnace roof. The clamps, which are operated by remotely controlled pneumatic mechanism, are mounted on the ends of horizontal arms which also carry the electrical and water connections. The horizontal arms are connected to vertical masts by cross-heads which, in turn, are suspended from flexible steel cables connected to individual winches.

These winches are installed below the furnace floor and are provided with drums over which the cables pass to terminate in counterweights. Each winch is driven through gearing from a direct-current motor, the field of which is permanently excited at constant voltage and the speed and direction of which depend on the magnitude and polarity of the output voltage of an Amplidyne constructed at the works of the British Thomson-Houston Co., Ltd.

All the controls and metering equipment for the furnace are situated on a board on the wall of the transformer sub-station.

New Books

Electronic Measuring Instruments. By E. H. W. Banner. Pp. 395; figs. Chapman & Hall, Ltd., 37, Essex Street, London, W.C.2. Price 45s.

Until comparatively recently many of those responsible for the measurement of physical quantities regarded electronic measuring devices with suspicion. This suspicion, which was based on the general instability of electron discharge devices, i.e., valves, etc., which change their characteristics with age and changes in electrode potentials, was to some extent justified because many early instrument designs were critically dependent upon valve characteristics. Modern design tends, however, to overcome these difficulties by the application of techniques such as negative feedback, resulting in the production of instruments which are virtually independent of changes in valve characteristics and electrode potentials over a very wide range. Parts I and II of Mr. Banner's book deal with the properties of indicating instruments and electron devices employed in instrument construction, and parts III and IV discuss the application of these components in actual measuring circuits.

In our opinion, this book should have been produced in two volumes; Volume I containing the subject matter of Parts I and II treated in greater detail, and Volume II containing parts III and IV in its present form. This would have permitted, for example, a more exhaustive discussion of feedback than can be conveniently presented on one page!

In spite of some errors this book will undoubtedly be of great value to the instrument user regarding the types and principles of operation of a wide variety of electronic instruments.—H.B.W.

Electrical Engineering Problems with Solutions. By F. A. Benson, M.Eng., Ph.D., A.M.I.E.E., M.I.R.E. Pp. 232. E. & F. N. Spon, Ltd., 15, Bedford Street, London, W.C.2. Price 25s.

The use of problems with solutions as a guide to education is becoming widespread, and any new ideas are welcomed. The author has managed to provide a few interesting innovations. First, the problems are given in papers (44 in all) of six questions each. These constitute the first 60 pages. The solutions follow.

This is a very sound method, since it encourages the student to attempt the questions rather than letting the eyes slip to the solution below. Secondly, there are alternative solutions to some questions, for example the network analyses are given in Kirchoff's Laws, Thévenin's (Helmholtz) Theorem, Superposition, Maxwell's Cylic-Currents, Millman's and Norton's Theorem (not necessarily all at once).

The scope of the work is first-year electrical engineering, i.e., electrochemistry, electromagnetism, d.c. meters, networks, electrostatics, d.c. machinery, illumination, r.m.s. values of a.c., etc., a.c. circuits, diode and triode valves.

The solutions are mostly in c.g.s. units, though the author has given some alternatives in m.k.s. Unfortunately, however, the *unrationalized* system is used, and this is unusual. With so few colleges using the unrationalized system, and lacking the support of most of the industry willing to change over, this system seems doomed. It appears that when a changeover *is* made, all possible simplifications should be adopted, and this is hardly the case with the unrationalized system.

The author apparently still uses forward and back pitch in drawing d.c. windings, and while *some* textbooks still advocate its use, the *majority* of lecturers and texts deprecate its use; preferring coilspan and commutator pitch as simpler techniques.

Finally there is no index: and thus the student is made to search the book if he requires a particular type of problem. The book will be most useful to both learner and engineer requiring a brush-up on principles.—E.H.S.

BOOKS RECEIVED

Generation and Transmission. By C. S. Beckett, B.Sc., A.M.I.E.E. Third edition. Pp. 124; figs. Blackie & Son, Ltd., 17, Stanhope Street, Glasgow, C.4. Price 8s 6d.

Electric Wiring (Domestic). Edited by E. Molloy. Fifth edition. Pp. 268; figs. 203. George Newnes, Ltd., Tower House, Southampton Street, London, W.C.2. Price 8s 6d.

Modern Fluorescent Lighting. By A. D. S. Atkinson, A.M.I.E.E., F.I.E.S. Second edition. Pp. 159; figs. 64. George Newnes, Ltd., Tower House, Southampton Street, London, W.C.2. Price 15s.

Magnetic Alloys and Ferrites. Edited by M. G. Say, Ph.D., B.Sc.(Eng.), M.I.E.E. Pp. 200; figs. 115. George Newnes, Ltd., Tower House, Southampton Street, London, W.C.2. Price 21s.

The Human Operator

A DISCUSSION before the Measurements Section of the Institution of Electrical Engineers on the human operator in closed loop control systems was opened on 18th January by Professor C. Holt Smith. The essential properties of the human operator that were unlikely to be replaced by any automatic system, he said, were a high visual acuity, a selective judgment and a flexibility of purpose. The human operator's ability to select relevant data from a background of irrelevancies was unapproachable by electronics. He might be likened to a digital computer with a store so vast that its contents were unknowable in entirety, while its response to a given instruction was unpredictable. Under certain conditions the response was proportional to input together with a component proportional to rate of change of input, but was delayed by 0·3 sec (Tustin). The conclusion to be drawn was that the human operator was a complex non-linear servo-mechanism with a performance that improved with training and yet decreased with fatigue and which was a significant source of noise. Whether the operator could ever be adequately represented by a formula was a matter for discussion.

Modernizing the Railways

Transport Commission's Electrification Proposals

ELECTRIFICATION and diesel traction schemes estimated to cost £345 million, out of a total envisaged expenditure of £1,200 million, are proposed in the British Transport Commission's Plan for the modernization and re-equipment of British Railways published this week. This is additional to the replacement of much existing steam-drawn passenger rolling stock, largely by multiple-unit electric or diesel trains, included in a further expenditure of £285 million which also covers the modernization of the remaining passenger rolling stock and improvements in the principal passenger stations and parcel depots.

The Plan is based on the premise that its main components shall be capable of being started within five years and completed within fifteen years, although certain works may take longer.

An estimated £210 million must be spent on improving track and signalling systems to make higher speeds possible over trunk routes. There will be an extended use of colour-light signalling, track circuits and automatic train control; the further introduction of power-operated signal boxes and the installation of centralized traffic control where conditions are suitable; and the extended use of modern telecommunication services.

The balance of the expenditure will be upon the modernization of freight services, including the adoption of continuous brakes on all freight wagons; and improvements at the "packet ports," staff welfare, office mechanisms, etc.

It is claimed that the result of carrying out the Plan will be a transformation of virtually all the forms of service now offered by British Railways. Remodelling of passenger service operation will result in fast, clean, regular and frequent services, electric or diesel, in all the great urban areas; inter-city and main-line trains will be faster and more punctual; and services on other routes will be made reasonably economic or will be transferred to the roads.

Freight service operations will be completely re-orientated to speed up movement and thus reduce costs, provide direct transits for main streams of traffic and attract a due proportion of traffic which would otherwise pass by road.

The Commission expects a minimum return from the expenditure of £85 million a year and further benefits will in the long run exercise a powerful influence upon the financial results.

Methods of Traction

Turning to methods of traction, the Commission says that it has decided that major changes in the forms of motive power must be made, involving a widespread change-over from steam to electricity and diesel power. Such developments are a pre-requisite of the improved quality required by industry and the travelling public, but equally they will lead to major economies in operation. Evidence from overseas has shown how new forms of motive power have increased railway efficiency. Accordingly the Commission proposes that after the 1956 programme no new express passenger or suburban steam locomotives shall be built and that the building of all new steam locomotives shall cease within a few years.

In the past the steam locomotive has served the railways well but the end of the steam era is at hand in view of the shortage of suitable coal; the demand for reduction of air pollution by locomotives and greater cleanliness in trains and stations; and the need for better acceleration. Steam traction also means a great deal of hard manual labour which is wasteful of man-power and makes the work unattractive.

Comparing electric and diesel traction the Commission says that in many ways electricity is the ideal, since it meets the requirements of reliability, good acceleration, cleanliness and (where the traffic is sufficiently heavy) economy in operation. With electrification the direct cost of train movement is considerably reduced as compared with steam, although because of the increased capital investment a certain minimum traffic density is required before electrification can compare favourably in total cost of operation; as the density increases the position of electricity becomes more favourable.

The main disadvantage of electrification is that it frequently involves substantial engineering works; conversion is a complex operation requiring a considerable period of planning and co-ordination between various railway departments and outside contractors and causing some disturbance of services during the execution of the work. Again, in some cases the riding qualities of electric multiple-unit stock have not equalled those of modern vehicles drawn by a separate locomotive. But it is confidently expected that as the result of research future designs will be entirely satisfactory.

Diesel traction offers many of the advantages of electricity and its substitution for steam operation generally does not involve important civil engineering or signalling works and the change can be made as quickly as the diesel units can be built. On the other hand, on the lines of heaviest traffic the potential economies are less with diesel traction than with electrification. As the present cost of a diesel locomotive is from two-and-a-half to three times that of a steam locomotive of equivalent power, diesel locomotives must be used almost to their theoretical availability to yield economic results.

It is recognized that atomic power will be used in the form of electricity and the extension of electrification will enable the Commission to take advantage of the possibilities flowing from the use of this source of power.

The Commission says that the choice is not between electricity and diesel traction; the aim is to combine them to the best advantage. The Plan is flexible enough to take advantage of any technical developments, including gas-turbine propulsion, that may become available and economically justified as the work progresses.

There is a wide and accepted field for electrification in suburban service and proposals for substantial schemes are set out below. Having regard to the foregoing considerations there is a limit to the amount of main-line electrification which it appears practicable to complete within the period covered by the Plan and this amount has been provided for.

As regards the remainder of the principal main-line services, it is intended to introduce diesel traction as quickly as possible. If it should be decided that it is practicable to electrify a section upon which diesel traction has already been introduced the diesel units would be used elsewhere.

Work is already proceeding with the extension of the Liverpool Street-Shenfield electrification to Chelmsford and Southend (Victoria). Plans for other schemes are in

various stages of development and it is proposed that these should all be adopted unless any unforeseen difficulties arise. These schemes are shown in the accompanying table.

TABLE I.—SUBURBAN ELECTRIFICATION SCHEMES TO BE ADOPTED

Route	Approximate route mileage	Estimated cost of fixed equipment (£ million)
London, Tilbury and Southend line	85	11
Liverpool Street to Enfield and Chingford ...	20	2
Liverpool Street to Hertford and Bishops Stortford...	35	4
King's Cross and Moorgate[1] to Hitchin and Letchworth, including the Hertford loop ...	60	5*
Glasgow suburban lines[2]	190	18

* Excluding signalling. [1] Choice of route for the Finsbury Park-Moorgate section not yet decided. [2] Based on Inglis Report, 1951, and subject to further study and discussion with Glasgow Corporation.

Southern Region Extensions

It has always been the intention to electrify, as soon as circumstances permit, all the main routes of the Southern Region east of a line drawn from Reading to Portsmouth. This will extend to the coast the electrified zone which now terminates at Gillingham, Maidstone and Sevenoaks, and carry the electric train services to Ramsgate, Dover, Folkestone and (via Ashford) to Hastings. In conjunction with the diesel services to be introduced, this will eliminate steam traction from all the lines of the Southern Region in the area mentioned. This programme will entail the electrifying of about 250 route miles at a cost of about £25 million for the fixed equipment.

Main Trunk Electrification

It is the intention to electrify the main line of the Eastern and North Eastern Regions from King's Cross to Doncaster, Leeds and (possibly) York, and the main line of the London Midland Region from Euston to Birmingham, Crewe, Liverpool and Manchester. A subsidiary main-line scheme will consist of the extension of the existing electrification from Liverpool Street (which will soon reach Chelmsford) to Ipswich, including the Clacton, Harwich and Felixstowe branches. In these areas there will be a virtual elimination of steam operation.

The estimated cost of the fixed installations for all these schemes is about £125 million and the cost of some 1,100 electric main-line locomotives will be about £60 million. The cost of the multiple-unit electric trains is included in the general comparison of present and future rolling stock in another part of the Plan (see Table 3).

Expert advice is being taken as to the capacity of the available technical staff and of the electrical manufacturing industry to carry out this very large programme. Should it appear necessary to limit the programme, one of the main routes concerned would in the meantime be converted to diesel traction, without prejudice to its eventual electrification.

Diesel Traction

Where the traffic is within their capacity a considerable improvement in net revenue can be secured from the replacement of steam services by diesel-powered trains, ranging from single units to six-coach trains. The introduction of these trains has already begun in various parts of the country.

Under the Plan a much wider extension of multiple-unit working will include city-to-city express services; secondary and cross-country routes; and branch lines. Present and future programmes will displace 1,500 steam shunting and trip locomotives by 1,200 diesel units.

Diesel traction may be regarded as a half-way house to electrification. By the end of the period covered by the Plan about 2,500 main-line diesel locomotives should be in operation. Early examples of their use will be in the Western Region between the West and London and Bristol and in the Southern Region between Waterloo and Exeter and Waterloo and Weymouth.

There are at present some 19,000 steam locomotives, a substantial proportion of modern design. A steam locomotive has a life of about forty years and the Plan mentions the arrangements for their selective and gradual elimination.

TABLE 2.—SUMMARY OF PROPOSED EXPENDITURE

	Structures, etc. (£ million)	Locomotives & rolling stock (£ million)	Total (£ million)
Electrification			
Main lines			
London Midland Region ...	40	35*	75
Eastern Region	20	25*	45
Total main lines	60	60*	120
Suburban lines	40	*	40
Southern Region extensions ...	25	*	25
Diesel Traction			
Main-line locomotives	—	125	125
Multiple-unit trains	—	*	*
Shunting and trip locomotives	—	25	25
Steam			
Motive-power depots	10	—	10
Total	135	210	345

* Multiple-unit vehicles are included in the estimate of 31,000 new passenger carriages, costing about £230 million, to be built during the period of the Plan.

A summary of the main items of expenditure proposed on new methods of traction is set out in Table 2.

It is stated that the changes in forms of motive power will necessitate a large carriage building programme and the main considerations governing this programme are stated. The changes which will be made in the character and numbers of vehicles are illustrated by Table 3 which shows that some 3,600 multiple-unit electric vehicles will be built.

TABLE 3.—COMPARISON OF PRESENT AND FUTURE STOCKS

Class	Approximate numbers	
	Present	Ultimate
Locomotive-hauled vehicles	37,200	23,200
Electric multiple-unit vehicles	4,800	8,400
Diesel railcars and multiple-unit vehicles ...	300	4,600
Total	42,300	36,200

The Plan provides for considerable improvements in the handling of freight traffic in marshalling yards and goods stations. Particular attention is given to continuous brakes on freight trains and economies in the employment of wagons.

Economics of the Plan

After stating that as soon as the Plan has been approved in principle "the administrative machine will be geared to it," the Commission points out that preliminary detailed planning will occupy a considerable period and large-scale results from major schemes, such as main-line electrification, cannot be expected until the Plan has been under way for some years. There will be some comparatively early benefits from annual building programmes, such as the construction of diesel multiple-unit trains and locomotives.

It is emphasized that it would be useless, or worse than useless, to limit the Plan so that the railways could continue in more or less their present shape and form. This would still cost almost half the expenditure now proposed and it would not be offset by improved results.

The proposed expenditure of £1,200 million upon this valuable national asset if spread evenly over fifteen years would represent an annual investment of £80 million—no more than 5 per cent of the gross capital formation of the country in 1953. Having regard to the expected rate of return and to the better employment of existing assets, it can be claimed that the rate of expenditure proposed can be attained and that the programme is realistic.

Of the total outlay of £1,200 million, it is estimated that some £400 million will be provided from internal resources. The annual interest and redemption charges on the balance of £800 million may be put at about £40 million plus about £15 million for increased depreciation charges. In addition, to put the railways into a healthy state and rectify the present inadequacy of net earnings, the current traffic receipts ought to be increased by about £25 million.

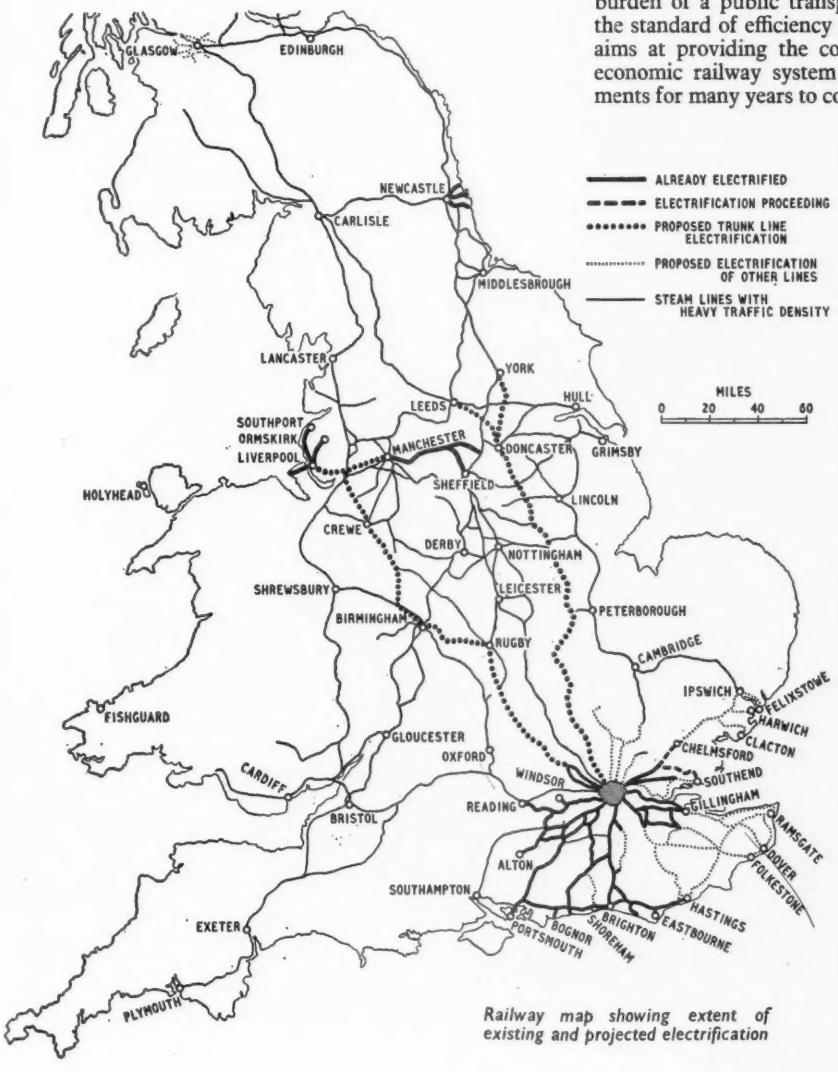
These three requirements amount to some £80 million a year. As already stated, the Commission expects a return from the investment of the order of £85 million and it might conceivably be much greater. In general terms, it is indicated how this improvement in revenue is expected to arise.

First passenger services are considered and it is shown that operational improvements will change the character of the service and secure substantial economies. Diesel power and electrification will result in faster and more frequent services and better loading. In this direction an extra £35 million of annual revenue is expected. By the reorganization of the freight services a further £60 million a year is thought to be obtainable. Against this total of £95 million is set a sum of £10 million for increased expenses.

The full benefit will not be reaped for many years ahead. In the meantime to avoid loss of traffic, which might never be regained, it will be necessary to continue to carry certain unremunerative traffics.

It is recognized that it will be necessary to provide for a faster rate of replacement in future to keep pace with the technical and commercial conditions in which the railways operate.

In its conclusion the Commission says that so far the railways have not been given a share of post-war capital investment comparable with that allocated to railways in many other countries. Now at last there is an opportunity to put this right. " It is not so much a question of whether the nation can afford to undertake the new investment in its railway system here proposed, as whether it can afford not to do so and thereby continue to carry the economic burden of a public transport system that lags far behind the standard of efficiency technically possible." The Plan aims at providing the country with a fully efficient and economic railway system adaptable to meet the requirements for many years to come.



Railway map showing extent of existing and projected electrification

At a Press conference on Monday the chairman of the Commission (Sir Brian Robertson) emphasized that the Plan was not a pipe dream but the result of deep thought and due regard for practical limitations. There were two main limitations: the amount of money available and the amount of constructional and manufacturing work which could be carried out within a given period. Execution of the Plan would only be possible with the utmost assistance from outside contractors and manufacturers of equipment. Parenthetically, Sir Brian remarked that manufacturers of railway equipment needed a reliable home market as a foundation for their vitally important export activities, and it was hoped that the scheme would in large measure provide the answer.

As to the details of the scheme, the chairman said that the priorities assigned to the various components could not be worked out until it was known whether the Government would give its approval in principle and until industry had been consulted. The Commission was already engaged upon modernization work within its present financial resources and these

projects would be caught up in the impetus of the larger Plan, the pace of which would be governed only by the capacity of industry and of the Commission to handle the different projects. The decision to electrify some lines and not others resulted from an endeavour to make the Plan realistic in the light of practical limitations, and to concentrate as far as possible on a single means of traction within an area or Region.

Discussing the economics of the proposals, Sir Brian Robertson said that the object was not merely to make the railway system self-supporting but to produce far-reaching benefits for the economy of the country as a whole. Heavy expenditure was inescapable even to preserve the railways in their present condition.

In replies to a question about the effect of the weather on electric railway services, the chairman said that it was mainly those operating on the third-rail principle that were affected. That system had certain advantages and they were very grateful for the work done by the former Southern Railway, but by and large the system adopted elsewhere would not be the third rail one. Later Mr. J. L. Train, technical member of the Commission, indicated that the 1,500 V overhead system would be largely used, with perhaps one section on the 25 kV 50 c/s system with which they were experimenting. Asked about the relative priorities for the main line scheme, Mr. Train said that he could not give a definite answer but the number of tunnels along the first part of the King's Cross route might be the reason for giving it some priority.

Copies of the Plan are obtainable from the Publicity Officer, British Transport Commission, 222, Marylebone Road, London, N.W.1, price 3s 6d.

Electrical Manufacturers' Views

Commenting upon the British Transport Commission's Plan, Colonel B. H. Leeson, director of the British Electrical & Allied Manufacturers' Association, said that they welcomed it as a bold and statesmanlike recognition of the benefits and economies to be derived from electrification of the railways and the coming of atomic power with all that they can mean for the future of this country.

They had been asked whether the electrical manufacturing industry could carry out the initial electrification Plan of £185 million proposed by the Commission. Colonel Leeson was able to state authoritatively that they had not only all the technical and manufacturing resources for the immediate requirements but also would be able to meet the further demand of the 15-year Plan.

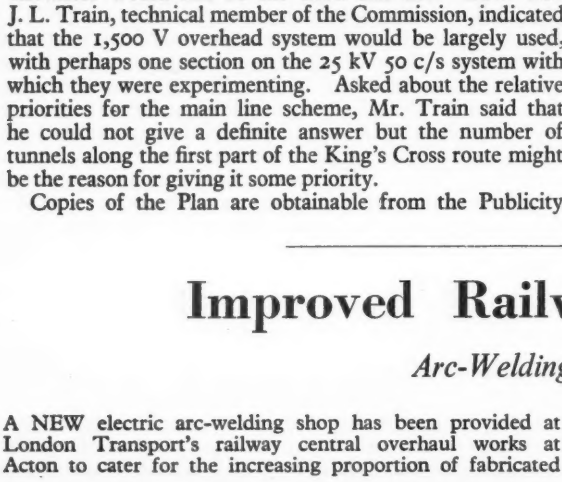
In building electric locomotives, multi-unit trains and equipment for railways throughout the world the electrical industry—the second largest exporting industry in the country—had unrivalled experience to place at the disposal of British Railways for the modernization of our own national system.

Further, the electrical manufacturing industry could undertake this without any diminution of its export drive. Indeed the steady home market which would be created by the electrification of British Railways would enormously benefit the British export trade and increase our prestige abroad.

Improved Railway Maintenance

Arc-Welding Shop at Acton

A NEW electric arc-welding shop has been provided at London Transport's railway central overhaul works at Acton to cater for the increasing proportion of fabricated components required in the maintenance of electric rolling stock. The shop incorporates two parallel rows of welding booths, with a rectangular space between them affording both access to the equipment and storage space for work in progress. The four booths in one row are for d.c. welding, and are supplied from two double-operator generators transferred from their former dispersed positions. The six booths in the other row are for the a.c. process and are served by a six-operator welding transformer, supplied by the English Electric Co., Ltd., with a maximum rating of 300 A per operator. At the end of the d.c. row is the foreman's office.



One of the ten booths in London Transport's new arc-welding shop at Acton

The a.c. welding current is distributed from the transformer, which is mounted on an overhead gantry, through cables carried in a longitudinal steel duct on the panel which forms the backs of the welding booths. Each booth contains a regulator, capable of handling welding currents up to the maximum, the connection between the regulator and the distributor cable being by plugs and sockets, as is the connection to the electrode holder. Each phase of the transformer supplies an adjoining pair of booths and it is possible, by paralleling, for currents up to 600 A to be used.

Fumes produced during the welding and cutting processes are withdrawn through exhaust ducts, one to each row of booths. To facilitate the lifting of work on to and from the welding tables, these are mounted on wheels and can, when required, be drawn forward on flush rails to positions clear of the overhead canopy. A two-ton electric overhead travelling crane, supplied by the Wharton Crane & Hoist Co., Ltd., and provided with floor-operated controls, handles heavy items of equipment. Each table is held in the welding position, at the rear of the booth, by a foot-operated latch. The half-doors forming the front of each booth are in three sections, the centre one being used for access and for small jobs while the remaining leaves can be opened as required for jobs of larger proportions.

VIEWS on the NEWS

By REFLECTOR

THE opening of electricity showrooms on Saturday afternoon has again been debated by the Southern Electricity Consultative Council. After previous discussions it had been arranged that certain showrooms in the area should remain open on Saturday afternoons for twelve months as an experiment. Naturally this is not liked by the staffs and there is much in the argument that the staffs' contentment is a primary consideration. The general practice is for shops of all other kinds to operate on Saturday afternoon, although there are exceptions—particularly in London. Advocates of Saturday opening rightly point out that the showrooms are provided for the benefit of the public and if there is a strong enough public demand they should be kept open. So far as the female section of the public is concerned it may be said that they have plenty of time in which to inspect appliances during the week. But then many women are nowadays in employment and can only manage showroom visits on Saturday afternoon; others prefer to have their husbands with them and, again, Saturday afternoon may be the only possible time for this. The Consultative Council has asked that representatives from the North Eastern Area (where Saturday opening is in operation) should meet the Southern Board to discuss their experience. Upon the result of these talks depends the decision whether to ask the Southern Board not to proceed with its experiment. Northern and southern ideas and habits often greatly differ but the experiment might be worth while after all.

* * *

Lakeland amenities are again the subject of Press discussion. The *Manchester Guardian* has published letters recently on the proposal to install overhead lines in Patterdale. While some correspondents think that, whatever the cost, the lines should be underground, one of them questions whether overhead transmission and distribution is so dreadful and introduces a somewhat novel note. He says:—

> "Patterdale, like all the dales, owes its unique æsthetic beauty to something already artificial and geometrical—namely the stone walls which pattern the flat valleys, enclosing lush green meadows in startling contrast to the sombre colour of the fells. Even the roads lined with stone walls suggest a map of the Great Wall of China. Telegraph poles or even pylons conveying electric cables would do no more than add a little inconspicuous punctuation to an already abstract design."

* * *

The intention of the British Transport Commission not to build any more steam locomotives after the next few years—if its electrification plans are approved—will no doubt dismay thousands of schoolboys and many grown-ups as well. Touching on this point on Monday, Sir Brian Robertson, chairman of the Commission, said that both the diesel and electric locomotives somehow lacked the glamour of the "great iron horse." I do not quite agree with this for in my opinion the diesel-electric locomotive, at any rate, symbolizes "pent-up power" nearly as well as its steam counterpart and I have found that the arrival of one at a station never failed to attract considerable interest among passengers. In any case it will, of course, be a long time before we see the last of the steam locomotive in this country for, with a life of some forty years, the latest to be built will be serviceable almost up to the year 2000.

* * *

Two news items that have come to my notice recently confirm my belief that the present system of local responsibility for the lighting of main roads is unsatisfactory. In the case of a road in the London suburbs, the installation of sodium lighting in one stretch of road would make this form of lighting standard throughout the length of the road, but it is recommended by the authority responsible for this particular section that this desirable improvement should be excluded from next year's estimates. In the second case, a standard type of lighting was held up for a long time because one authority favoured a form different from the rest. It seems to me that where urban areas are contiguous regional administration of street lighting is to be preferred.

* * *

A great deal of discussion goes on nowadays about the standing of the engineer. It is rightly thought that he is not given the full recognition (and rewards) which his work merits and there is also the question of the abuse of the term "engineer." All the same, I am sure that there has been some improvement in the past half century. Fifty years ago (27th January, 1905) there appeared in the *Electrical Review* the following letter from Mr. Cyril R. Heron, of Huddersfield, under the heading "The Dignity of the Profession," which indicated a queer state of affairs at that time:—

> "As the involuntary cause of the correspondence under the above heading, and as some of your corespondents have scarcely got the correct version of my resignation, I would claim your permission to state, as briefly as possible, the true reasons.
>
> "The Council in question, without any advice, or even consultation with me, passed a resolution that the assistant engineer was to send in his resignation, and that the jointer was to help in running the plant, and at the same time do all outside work that was necessary. Now, as the staff only consisted of one stoker, one jointer, an assistant and myself, to be deprived of my principal assistant, in face of the heaviest load of the year (December), and to have in his place a jointer, was more than I could stand. I wrote to the Committee, asking them to rescind the resolution, which they, in their wisdom or parsimoniousness, declined to do, in consequence of which I immediately sent in my resignation.
>
> "If there is any credit attached to taking such a step to support the 'Dignity of the Profession,' I should like some of the credit also to fall upon the jointer, who has been with me in three stations that I have been connected with, and who, on being approached by some of the Council on the above subject, let them know that they had got hold of the wrong man in this case, as he indignantly declined to take his 'master's job.' He gave notice, and within a week was quickly swept up by a brother engineer."

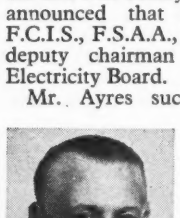
PERSONAL AND SOCIAL

News of Men and Women of the Industry

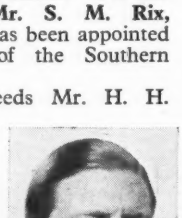
Mr. B. W. Ricks, A.M.I.E.E., A.M.I.A.A., has been appointed assistant chief engineer (construction) to the South Western Electricity Board. He received his technical education at the Plymouth and Devonport Technical College and served a short student apprentice course with the British Thomson-Houston Co., Ltd., at Rugby before entering the electricity supply industry with the Plymouth Corporation. Soon after nationalization he was appointed deputy engineer in the Torbay and West Devon Sub-Area and later transferred to the Bristol Sub-Area. Mr. Ricks is well known in the South West for his service over many years on various committees of the Electrical Power Engineers' Association (and the No. 4 District Joint Board). He has been for many years vice-chairman of the Devon Section of the E.P.E.A., and he has just relinquished his chairmanship of the West of England Section. He is also a member of the National Executive Council.

The Minister of Fuel and Power has appointed **Mr. T. M. Ayres,** M.I.E.E., to fill the vacant chairmanship of the North Eastern Electricity Board and **Mr. R. R. B. Brown,** B.A., B.Sc., M.I.E.E., to be chairman of the Southern Electricity Board in place of the late Mr. Henry Nimmo. It is also announced that **Mr. S. M. Rix,** F.C.I.S., F.S.A.A., has been appointed deputy chairman of the Southern Electricity Board.

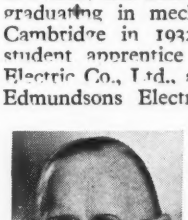
Mr. Ayres succeeds Mr. H. H. Mullens, B.Sc., M.I.E.E., who resigned from the North Eastern Electricity Board in May last to take up the position of managing director of A. Reyrolle & Co., Ltd. Mr. Ayres, who has been deputy chairman of the Board since 1953, was educated at Hammond's Grammar School, Swaffham, Norfolk, and entered the electricity supply industry as an articled pupil with the Urban Electric Supply Co. (a subsidiary of Edmundsons Electricity Corporation, Ltd.), at its Stamford and Grantham electricity undertakings. From 1914 to 1918 he was on the generation and distribution staffs of the Cleveland & Durham Electric Power Co., and after a short period as a cadet in the R.A.F. he joined the staff of the North-Eastern Electric Supply Co., Ltd., in 1919 as an assistant electrical construction engineer in the company's South Durham and Yorkshire areas. In 1924 Mr. Ayres was appointed assistant engineer in charge of electrical construction work in those areas, and held this position until he was transferred in 1935 to the company's headquarters at Carliol House, Newcastle-upon-Tyne, as chief assistant to the electrical construction engineer. In 1937 he became deputy engineer, and about six years later was appointed chief engineer of the Operation (Transmission and Distribution) Department of the company. He was appointed chief electrical engineer in 1946, and held this appointment at vesting date when he became chief engineer of the North Eastern Board. Mr. Ayres was chairman of the North Eastern Centre of the Institution of Electrical Engineers for the 1946-47 session.



Mr. T. M. Ayres



Mr. R. R. B. Brown



Mr. S. M. Rix

Mr. Brown has been deputy chairman of the Southern Electricity Board since its inception. He was educated at Sydney and Cambridge Universities, graduating in mechanical science at Cambridge in 1932. He became a student apprentice with the English Electric Co., Ltd., and in 1934 joined Edmundsons Electricity Corporation. After a period as a trainee with an associated company, the Shropshire, Worcestershire & Staffordshire Electric Power Co., and two years as personal assistant to the general manager and managing director of Edmundsons, he was appointed deputy general manager of the Wessex Electricity Co. in 1938. He served in the Royal Armoured Corps in Libya and Normandy from 1940 to 1945, and returned to the Wessex Co. as general manager on being demobilized.

Mr. Rix has been deputy secretary of the British Electricity Authority since the end of 1947. He was educated at Shoreham Grammar School and received his training with Foulks, Lynch & Co. From 1927 to 1945 he was secretary and accountant of the Lancashire Electric Power Co. and the Lancashire Electric Light & Power Co. and a director of the Ormskirk Electric Supply Co., and from 1945 to 1948 he was secretary and assistant manager of the Lancashire Electric Power Co.

Mr. J. Sewell has been appointed lamp sales manager of Crompton Parkinson, Ltd., in succession to **Mr. W. A. Benson.** Mr. Sewell has served in a number of capacities on the sales staff of the company's supplies division since 1932, having been responsible for, among other duties, the opening of the Liverpool office in 1937 and the management of the supplies division branch at Leeds from 1946 to 1953. During the war he served with the Royal Corps of Signals, and for the last eighteen months he has been assistant to Mr. Benson.

Mr. J. Sewell

Mr. Benson will continue to maintain his association with the electric lamp business in his new appointment on the executive sales staff of the Supplies Division.

Mr. H. de C. Falle, O.B.E., A.M.I.E.E., who has completed over fifty years in the electrical industry, is relinquishing, on 31st January, the position of general sales manager of Aberdare Cables, Ltd., which he has held since the company commenced production. He will remain on the boards of Aberdare Cables (Holdings), Ltd., and of the two operative companies, Aberdare Cables, Ltd., and South Wales Switchgear, Ltd. **Mr. W. R. Hall,** who has been export manager for some years, will continue to operate from the London office. **Mr. C. A. Hutchinson,** M.I.E.E., for many years Aberdare Cables' representative in India, will be responsible for home sales with headquarters in London.

Sir Ronald C. Stewart, Bt., deputy chairman of the London Brick Co., Ltd., has joined the board of Transformers (Watford), Ltd.

Mr. R. E. Smith has been appointed superintendent at the Beckenham generating station, following the retirement of Mr. J. H. Padbury. After service with the Battersea Borough Council Mr. Smith became charge

engineer at Beckenham in 1946 and was appointed assistant to the superintendent in the same year.

Mr. J. T. O'Grady, district manager, Bristol, of Hoover, Ltd., has taken over the post of district manager, Dublin, and **Mr. K. B. Holman** becomes district manager, Bristol. Mr. Holman was a supervisor in the Bournemouth district.

Sir Harry Harrison Burn has been appointed chairman of the Calcutta Electric Supply Corporation, Ltd., in succession to **Sir James Donald,** who has relinquished that position, but retains his seat on the board.

The annual apprentice prize-giving of **George Kent, Ltd.,** was held at Luton on 10th January and a large gathering of visitors, parents and friends attended. The number of apprentices in the company's scheme is now 132. Mr. D. Williams, director of Pendley Residential Centre of Adult Education, gave an address. The prizes were presented by Commander P. W. Kent, R.N. (Retd.), chairman and managing director, and a vote of thanks was proposed by apprentice M. C. Ellison. An exhibition of the work of apprentices was held in conjunction with the prize-giving.

Mr. F. A. Leonard, sales director of Brookhirst Switchgear, Ltd., one of

Mr. F. A. Leonard

Mr. J. G. Frater

the Metal Industries group of companies, will be retiring from that position on 31st March, but will remain a director of the company in an advisory capacity. **Mr. J. G. Frater,** sales manager, has been appointed a director as from 1st January last.

Members of the **Electrical Trades' Commercial Travellers' Association** met at the Feathers Hotel on 14th January for the opening supper and meeting of 1955. The sectional officers gave their individual reports and it was stated that the membership had increased during 1954. The chairman, Mr. J. H. Bowen, announced that the next supper and general meeting would be held on 11th March.

Commercial travellers in the electrical trade in

At the Northern Counties E.D.A. Carnival. Left to right: Mr. S. G. Pike, Mrs. Pike, Miss C. Parkin, Mrs. Dale, Mr. V. W. Dale and Mr. A. Parkin

the Manchester, Liverpool and West Yorkshire districts are invited to an informal meeting at the Grand Hotel, Manchester, on 14th February.

The death of Mr. D. Goldberg, sales manager of Keith Blackman, Ltd., which we record in our obituary section, has necessitated certain staff reorganization of the company. **Mr. C. J. Atkins** has been appointed sales manager, **Mr. A. H. Woodley** becomes assistant sales manager, **Mr. F. W. Goodge** takes up the position of contracts manager, and **Mr. D. Humphrey** is appointed assistant to the chief engineer. The appointments date from 1st February.

The following have been appointed as chairmen of the various C.M.A. Committees for 1955:—**Mr. W. Lewis Smith,** director, Pirelli-General Cable Works, Ltd., has been appointed chairman of the Cable Makers' Association; **Mr. R. A. Bebb,** Crompton Parkinson, Ltd., chairman, Mains Cable Manufacturers' Association; **Mr. H. E. Helwig,** Siemens Brothers & Co., Ltd., has been re-elected chairman of the Mains Cable Manufacturers' Association (Super Tension) for the second year; **Mr. H. Lockett,** St. Helens Cable & Rubber Co., Ltd., has been appointed chairman, Overseas Rubber Cable Manufacturers' Association; and **Mr. H. H. Townsend,** director, Greengate & Irwell Rubber Co., Ltd., chairman, Rubber and Thermoplastic Cable Manufacturers' Association.

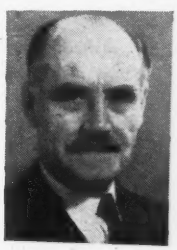
The Carnival in the North East of the **British Electrical Development Association** was held on 14th January at the Oxford Galleries, Newcastle-on-Tyne, when Mr. V. W. Dale, director and secretary of E.D.A., and Mrs. Dale received over 1,000 guests. They were accompanied by Mr. J. Gibson (chairman, North-Eastern Area, E.I.B.A.), Mr. S. G. Pike (chairman, E.D.A. Carnival Committee) and Mrs. Pike. The accompanying picture shows Miss Christine Parkin, daughter of Mr. A. Parkin (organizer of the Carnival), presenting a bouquet to Mrs. Dale.

The first annual general meeting of the North Metropolitan branch of the **Electrical Industries Benevolent Association** was held on 12th January. The chairman's report showed that good progress had been made during the past year. The retiring committee was re-elected for the ensuing year. The chairman is Mr. H. G. Campbell. Mr. Campbell thanked Mr. C. C. Hill for the able way in which, as chairman, he had conducted the branch's affairs during his first year. Mr. Hill paid tribute to the valuable assistance he had received from Mr. T. Yule (hon. secretary), Mr. D. W. Kaye (hon. treasurer) and Mr. T. W. Norman (hon. assistant treasurer).

The annual party given by the directors of **Gresham Transformers, Ltd.,** to their staff and employees was held on 14th January at York House, Twickenham, Mr. R. Gresham Cooke of the Society of Motor Manufacturers and Traders being the guest of honour. In presenting long service awards, Mr. Cooke referred to the Gresham transformers he had seen in use in the motor trade for body welding and

Mr. W. Lewis Smith

Mr. R. A. Bebb



Mr. H. E. Helwig

Mr. H. Lockett

Mr. H. H. Townsend

At the I.E.E. Utilization Section dinner: Mr. J. D. Peattie (chairman, Supply Section), Mrs. J. I. Bernard, Mr. J. Eccles (President I.E.E.), Mrs. Peattie, Mr. J. I. Bernard, Mrs. Eccles and Mr. M. Whitehead (chairman, Measurements Section)

expressed his confidence that the company would play its part in the 20 per cent expansion programme which the motor trade had planned this year. Mr. Kenneth Horne also spoke. In introducing the speakers, Mr. J. P. Coleman (managing director) referred to the healthy state of the order book.

The annual dinner-dance of the Utilization Section of the **Institution of Electrical Engineers** was held at the Café Royal, Regent Street, London, on 19th January and it proved a very successful function. The guests were received by Mr. J. I. Bernard, chairman of the Section, and Mrs. Bernard. We reproduce a photograph of the top table taken at the dinner.

Mr. H. M. Steward, who has been nominated as Conservative candidate for the Stockport South by-election, is an engineer with British Insulated Callender's Cables, Ltd., Prescot. The vacancy was created by the elevation of Sir Arnold Gridley (now Baron Gridley of Stockport) to the peerage.

Mr. J. A. Crabtree, managing director, J. A. Crabtree & Co., Ltd., has accepted an invitation from the Walsall Chamber of Commerce to become a governor of the University College of North Staffordshire.

A two-day conference was recently held by the Radio Sales Division of **E. K. Cole, Ltd.** Among the guests who attended the dinner which marked the closing of the conference were Mr. E. K. Cole, chairman and managing director, Mr. E. B. Willcocks, director and secretary, Mr. F. S. Allen, works director, and Mr. A. W. Martin, technical director. At the dinner farewell presentations were made to Mr. Lawson-Thomas of a suite of Stuart crystal glasses from the company, and a silver salver and vellum scroll from his colleagues on the outside sales representatives' staff.

OBITUARY

Lady Devonshire. — The death occurred on 19th January, at Putney Heath, of Lady (Wilhelmina Walker) Devonshire, the widow of Sir James Devonshire, K.B.E., M.I.E.E., who had been vice-president and hon. treasurer of the Institution of Electrical Engineers, deputy chairman of the Northmet Power Co. and a member of the Central Electricity Board.

Mr. D. Goldberg.—The death occurred on 4th January of Mr. D. Goldberg, sales manager of Keith Blackman, Ltd. He had been with the company for over thirty-eight years.

STREET LIGHTING NOTES

MIDDLESBROUGH Town Council is to spend £7,940 on the provision of 130 street lamps on the Park End housing estate. The tender of the North Eastern Electricity Board at £4,800 has been accepted for the electrical work. It is proposed to use G.E.C. lanterns and Stanton columns.

MORPETH Town Council has submitted to the Ministry of Transport estimates received for a proposed electric street lighting scheme. The total cost will be about £8,000 which includes taking out old gas mains and restoring the roads. The electrical work will cost about £5,000.

SUNDERLAND Town Council has received loan sanction for £11,510 for the provision of improved lighting in Chester Road, Thompson Road, Fulwell Road, Southwick Road, Sunderland Road, Church Bank and North Hylton Road.

THORNABY-ON-TEES Town Council has approved a revised scheme for lighting in trunk road A.67 at a cost of £1,950. Plans have also been prepared for lighting Lanehouse Road (£3,600) and Westbury Street (£930) and schemes for other streets are under consideration.

WIGTON (Cumberland) R.D.C. has been informed by the Ministry of Transport that funds are not available at present for proposed trunk road lighting at Wigton and Aspatria. The Council is to raise the matter again at the beginning of the next financial year.

The first year's scheme for the block conversion of gas street lighting to electricity at BARROW-IN-FURNESS has now been prepared. It provides for the erection of 260 electric lamps at an estimated cost of £9,925.

ECCLES Corporation Highways and Town Planning Committee has authorized the borough surveyor to invite tenders for the carrying out of schemes for improving the lighting of Barton Lane at an estimated cost of £2,650, Peal Green Road (£2,750), part of Monton Road, Wellington Road and Albert Street (£2,450) and New Lane (£1,600). Sodium lighting is proposed.

COLERAINE Council has approved a draft scheme prepared by the Northern Ireland Electricity Board for lighting the streets with fluorescent lamps. The estimated cost is £31,060.

Street lighting at CARSHALTON (Surrey) is to be converted from gas to electricity.

The only part of the Birmingham-Wolverhampton New Road not yet provided with modern lighting is a half-mile section at the boundary between DUDLEY and TIPTON. The reason is that while Dudley Corporation prefers sodium lighting Tipton Corporation favours mercury-vapour. A deputation from Tipton is to discuss the matter with Dudley representatives.

Prices of Materials

In the accompanying table we give the basis prices of the more important materials used in the electrical industry. The figures given are the selling prices and are those quoted on Tuesday last.

ALUMINIUM Ingots	ton £163 0s 0d
COPPER, H.C. Electro	ton £305 10s 0d
Fire Refined 99·70%	ton £304 0s 0d
Fire Refined 99·50%	ton £303 0s 0d
COPPER Tubes ..	lb 2s 10½d
Sheet	ton £360 5s 0d
H.C. wire and strip ..	ton £337 0s 0d
LEAD, English ..	ton £103 5s 0d
Foreign	ton £102 0s 0d
MERCURY	flask £106 0s 0d
TIN, block (English) ..	ton £694 10s 0d
ZINC, G.O.B. Foreign	ton £85 15s 0d
Electrolytic	ton £90 10s 0d
BRASS Tubes (solid drawn)	lb 2s 3⅛d
Sheet	ton £289 5s 0d
Wire	lb 2s 10½d
PHOSPHOR BRONZE Wire	lb 4s 3⅛d
PLATINUM	oz £30 0s 0d
RUBBER, No. 1 R.S.S. spot	lb 30⅜d—30½d

Sign Design Competition

It has been decided to postpone the closing date for the Sign Design Competition sponsored by the Electrical Sign Manufacturers' Association. All entries must now arrive at the Association's offices not later than Monday, 7th February.

Vehicle and Road Lighting

FOUR papers were presented at a recent conference on vehicle and road lighting arranged by the Automobile Division of the Institution of Mechanical Engineers. In the first, relating to rear lights and reflectors, by Dr. K. N. Chandler and Mr. J. A. Reid (Department of Scientific and Industrial Research) and Mr. K. J. Jones (Joseph Lucas Electrical), it was stated that the cost of accidents that could have been avoided by adequate rear lights amounted to about £2 million per annum.

Improvements in respect of private cars were shown by records of two-vehicle accidents, which revealed a day-to-night ratio of 1 to 2·3 for pre-war and 1 to 0·4 for post-war models. For commercial vehicles, however, the ratio had remained unchanged at 1 to 2·2. The paper dealt in detail with the seeing distance and angular coverage required and the desirable standard of performance of refractors.

The second paper, on street lighting performance, was by Messrs. H. R. Ruff and G. K. Cambert (British Thomson-Houston Co.), who set out the four objects as: convenience and safety of road users; police purposes; convenience of residents; and special purposes, including higher illumination levels and non-directional lighting in shopping and important urban centres. Vehicles should not have to use headlights in built-up areas, except possibly in fog. An average road brightness of 0·2 ft-lamberts with controlled glare and without excessive diversity was adequate for indicating clearly obstacles and other road users in silhouette.

A method of appraisal of the effectiveness of street lighting installations, based upon principles and practices discussed and including a study of glare, was described. Its application to some installations was as set out in the accompanying table.

Since the use of headlights was left to the discretion of drivers it was suggested that the limitation in mounting height on roads other than traffic routes should be relaxed sufficiently to enable lanterns to project over the road to improve lighting, especially in tree-lined streets; a height of 17ft 6in would enable lanterns to project safely. Good lighting in residential areas, adequate even in wet weather, had been obtained by using short fluorescent lamps in lanterns mounted at 15ft on the pavement with 120ft spacing.

Improved lighting on wet roads had been obtained by the use of rough non-flooding surfaces to retain the width of the bright patches under considerable rainfall. The extension of fluorescent lighting had shown the value of long low-brightness light sources mounted across the road as the surface became polished or flooded.

Representational photography and Bouma's visibility meter were particularly suited to investigational work to develop street lighting techniques and the Reid-Chanon street lighting evaluator gave practical guidance regarding adequacy of lighting systems.

The remaining papers were concerned with headlamp meeting beams (i.e., the beam used when other vehicles approached). One by Dr. J. H. Nelson (Joseph Lucas) covered design and use regarded as a branch of illuminating engineering and included information on Continental and U.S.A. practice. No significant improvement in visibility distance was found by using yellow filters, although glare was generally believed by drivers to be lessened. In appreciation tests, however, the quality of the lighting system as a whole, rather than some individual features, determined their judgment.

In the other paper, Mr. G. Grime (D.S.I.R.) advocated complete uniformity in practice by the following means: adopting one design of beam (that fitted to new cars being suitable); specifying the way the beam was aimed; specifying a limit of beam deterioration; using no extra lamps; specifying intensity and orientation with which beams from lamps of earlier designs should comply; devising effective means to ensure adherence to requirements regarding aim and deterioration.

APPRAISAL OF SOME INSTALLATIONS

Installation	1	2	3	4	5	6	7	8	9	10
Light Source	Tungsten Filament 750 W	Tungsten Filament 300 W	Mercury Discharge 400 W	Mercury Discharge 250 W	Sodium Discharge 140 W	Sodium Discharge 140 W	Sodium Discharge 140 W	Horizontal Fluorescent 3×90 W	Horizontal Fluorescent 3×80 W	Vertical Fluorescent 3×80 W
Light Distribution	Highly Directional 79 deg	No Control in Vertical Flane	Medium Angle Beam 77 deg	Medium Angle Beam 73 deg	High Angle Beam 75 deg	Medium Angle Beam 75 deg	Medium Angle Beam 77 deg	Broad Beam at 65 deg	Broad Beam at 65 deg	Broad Beam at 90 deg
Spacing (ft)	150+	80	150	120	120	135	150	120	110	80
Approx. Lumens/100ft in Lower Hemisphere	6,000	4,500	5,000	4,200	5,000	5,000	4,000	7,000	7,000	4,200
Road Surface	Rough with Patchy Surface Dressing	Worn Surface Dressing	Rough with Patchy Surface Dressing	Tar Macadam	Tar Macadam	Damp Tar Macadam	Tar Macadam	Tar Macadam	Worn Tar Macadam	Tar Macadam
Surroundings	Residential	Residential	Residential	Residential	Residential	Trees	Buildings one side	Built-Up	Built-Up	Buildings one side
Road Brightness (Foot-Lamberts):										
Average	0·1	0·11	0·08	0·25	0·22	0·31	0·07	0·37	0·18	0·17
Maximum	0·23	0·28	0·18	0·72	0·51	0·97	0·15	0·98	0·44	0·38
Minimum	0·03	0·05	0·03	0·06	0·06	0·05	0·023	0·09	0·05	0·06
Diversity	7/1	6/1	6/1	12/1	9/1	20/1	6½/1	11/1	9/1	6½/1
Mean Vertical Illumination (E_m)	0·3	0·28	0·36	0·36	0·40	0·35	0·28	0·44	0·38	0·37
Disability Glare (B_a/B_b)*	2·5	1·7	1·25	1·4	1·26	1·7	1·43	1·15	1·4	1·67
Overall Revealing Power of Road Surface (per cent)	76	82	80	98	98	99	82	100	92	85
Discomfort Glare: Constant Evaluation	0·23 Just Tolerable	0·85 Just Uncomfortable	0·60 Just Uncomfortable	1·40 Distracting but not Uncomfortable	3·02 Distracting but not Uncomfortable	5·40 Perceptible but not Distracting	2·00 Distracting but not Uncomfortable	9·90 Perceptible but not Distracting	4·15 Satisfactory	2·93 Distracting but not Uncomfortable

* B_a = Adaptation Brightness. B^b = Background Brightness.

Municipalities and Boards

A SUGGESTION that the structure and method of charging for electricity are now so complicated and technical that only a technical man can really understand them, particularly the industrial and commercial tariffs, is made by the Association of Municipal Corporations in a memorandum to the Minister of Fuel and Power's committee of inquiry into the electricity supply industry (the Herbert Committee). It is also complained that the Electricity Boards fail to give adequate notice of proposals to alter their tariffs and to give adequate explanations.

It was realized that the tariffs recently introduced by Area Boards were intended to simplify and standardize methods of charge, but the substitution of complicated methods of charging had led many domestic consumers to believe that the charge was just an indirect method of increasing charges. This has contributed to the loss of confidence by the general public in the operation of the new electricity undertakings.

The Association, while making it clear that it has never liked the device of Consultative Councils, suggests that the nature and functions of these bodies were not sufficiently well known to consumers generally, and not being elected bodies they were too remote to restore confidence to consumers in the fairness of their treatment.

Unless the system of consultative councils was drastically revised or a new system substituted for it, there was much to be said for requiring tariffs to be submitted for approval to independent tribunals before which all changes would have to be justified with an opportunity for objections to be heard in public.

There was not sufficient consultation between Boards and local authorities about tariffs and charges affecting the services and establishments of local authorities which was likely to impair relationships between the Boards and the authorities. There was also a widely held view among local authorities that charges for electricity supplied for public lighting (an off-peak load) were too high.

The Association also refers to complaints that, under the present system, there were long delays in laying mains and service for housing estates and in providing street lighting. The maintenance of street lighting systems by area boards under contract with the local authority also appeared to be inferior and less expeditious than that formerly undertaken by the lighting departments of the authorities themselves. Where Electricity Boards were invited to tender for wiring contracts in connection with housing schemes their prices were usually higher than those submitted by private contractors.

Elsewhere in the memorandum the Association suggests that there is no effective method by which the attention of Parliament can be drawn to unwise or unnecessary expenditure either by the British Electricity Authority or the Electricity Boards. It also presses its long-standing claim that a service of this nature should be controlled by elected representatives and not by persons nominated by the Minister.

Air Pollution

AT a meeting of the Institute of Fuel on 20th January, a discussion of the report of the Committee on Air Pollution (the Beaver Report) (*Electrical Review*, 3rd December) was opened by Dr. G. E. Foxwell, a member of the Committee. After summarizing the main features of the recommendations, which he emphasized were required to be practicable and such as would be actively supported by public opinion, the speaker divided the proposals into two parts, technological and administrative. The first was mainly a problem in fuel technology.

Only a partial solution of the sulphur problem could at present be envisaged, but the action of SO_2 would be considerably reduced in the absence of the particles which comprised coal smoke, so the first need was to prevent the emission of smoke, grit and dust. The production of smokeless fuels to replace house coal entailed problems in coal cleaning and in using the middle fractions. The Committee had asked that the British Standards Institution should formulate standards for domestic solid smokeless fuel.

Industrial smoke elimination required only the putting of coal burning plant into a sound condition and operating it by trained men, but the value of compulsory certification of operatives was doubtful.

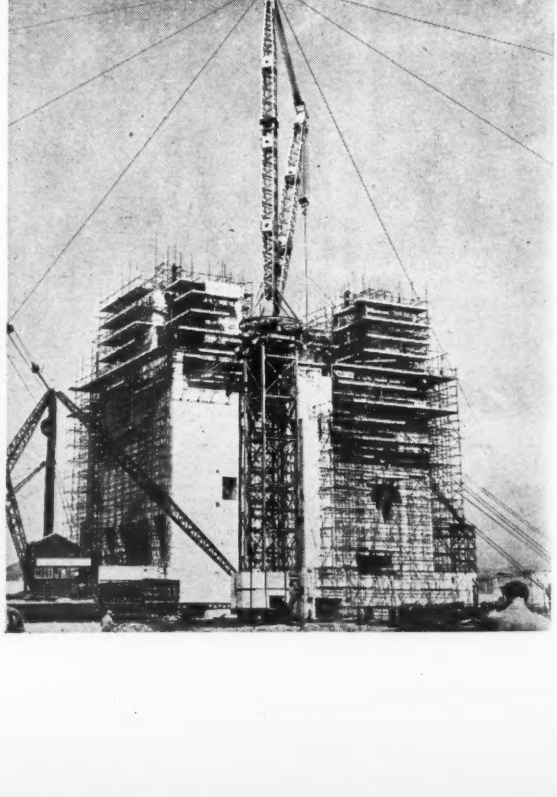
The question of smokeless or smoke-controlled zones was left to the local authorities to decide by pressure of public opinion. In the "black areas" (those experiencing a high frequency of fog and industrial density), 19 million tons of large house coal (10 million tons being of carbonizable quality and low in ash) could be freed for export by substitution of smokeless fuel. Coke of the required quality could be obtained by blending non-coking with coking coal.

Mr. J. D. Peattie, deputy chief engineer (generation), British Electricity Authority, said he did not believe that gas washing could be effectively introduced in power stations as the equipment would cost at least £140 million to install and perhaps as much as £250 million. This would increase the cost of electricity by 12 per cent which would have to be passed on to the domestic and industrial consumers.

Reference was made to the introduction into Parliament of a Private Member's Bill (by Mr. Gerald Nabarro), which was to come up for second reading on 4th February. The Institute of Fuel discussion will be resumed on 2nd February at the Institution of Civil Engineers.

Atomic Power Station

THE accompanying picture shows one of the two identical reactors now being built at the Calder Hall, Cumberland, atomic power station. Each of these reactors will consist of natural uranium, embedded in graphite and cooled by carbon dioxide under pressure inside a huge pressure shell. The carbon dioxide circulates through heat exchangers, of which there will be one at each corner of the building to create steam for turbo-generating plant. It is expected that the plant will be ready for operation next year. The civil engineering and building work is being carried out by Taylor Woodrow Construction, Ltd., on behalf of the United Kingdom Atomic Energy Authority.



INDUSTRIAL NEWS

Electricity Workers' Pay Increase

A statement issued by the National Joint Industrial Council for the Electricity Supply Industry last week said that it had been agreed that the rates of all manual workers should be increased by 3d an hour with effect from the first full pay period following 1st January. Wages of certain operational and maintenance grades would be increased by further amounts ranging from ½d to 1d an hour. The rates of foremen are increased by £40 per year.

Clerical Staffs' Salary Rise

About 43,000 clerical and administrative employees of the British Electricity Authority and Electricity Boards have been granted increases in salary amounting to about £1½ million a year. The increases date from 1st January. For men they range from £25 a year in the general clerical grades to £80 for the higher grades. For women in the general clerical grades there has been a further move towards the implementation of the principle of equal pay, with increases ranging from £32 to £40 a year. It is stated that the effect is to raise the salaries of these women employees from 80 per cent to approximately 85 per cent of the male rate. Women in the higher grades, who already have equal pay, get from £35 to £80 a year more. Junior employees' salaries have been raised proportionately.

Engineering Staffs' Claims

The Engineering and Allied Employers' National Federation on 20th January rejected a claim by all unions representing staff workers for a minimum of three weeks' holiday with pay after twelve months' service. The Federation also rejected a claim by the Clerical and Administrative Workers' Union for a wage scale for clerical workers rising from £7 2s 6d at 22 to £8 5s at 25. The present minimum is £6 15s a week at 21.

The Association of Engineering and Shipbuilding Draughtsmen has submitted a claim for increases for draughtsmen of 15s at 21, of 17s 6d at 23-24, and of 20s at 25, with increases of 15s for women from the age of 19. The Federation will give its reply later.

E.D.A. and Purchase Tax

In a memorandum to the Chancellor of the Exchequer the British Electrical Development Association presents the case for the removal of purchase tax from domestic electrical appliances, which it points out are not luxuries but necessities. Realizing that it may be impossible to exempt all appliances at once, the Association sets out the order in which it considers the appliances should be freed from tax. "Priority" consideration should be given to the following electrical appliances:—Water heaters, washing machines, vacuum cleaners, refrigerators and space heaters.

It also recommends that off-peak storage heaters, sales of which are now restricted to commercial and industrial users, should be made available to domestic users free of tax. Impetus should be given to the production of the domestic heat pump by an announcement that this new appliance will be available without tax.

Reasoned arguments are put forward in the case of each appliance, as has been done in previous years. One new point is the Beaver Committee's recommendation that to encourage the displacement of coal in the home purchase tax should be removed from gas and electric room and water heaters.

Portable Tool Safety

A paper entitled "Portable Electric Tools" was read by Mr. J. H. Longland (Black & Decker, Ltd.) to Southern Group members of the London Industrial Committee of the Royal Society for the Prevention of Accidents last week at the Safety, Health and Welfare Museum, Horseferry Road, London. Mr. Longland stressed the importance of the proper care and maintenance of electric tools from the point of view of safety of the user. He referred especially to adequate earthing, and careful inspection at regular intervals was advocated.

Following the paper a short film was shown and demonstrations of the tools in action were given.

Transformers for Italy

Transformers (Watford), Ltd., have secured a contract from Italy for Class "H," air-cooled, silicone impregnated distribution transformers.

E.D.A. Sales Conference

The annual E.D.A. Sales Conference will be held in London from 26th to 29th April, inclusive. The proceedings at the first three days of the Conference will take place at Caxton Hall, Westminster, and the final session on Friday will be held at the Connaught Rooms, Great Queen Street, W.C.2. The provisional programme includes an opening talk on "Load Factor Improvement" by Mr. S. W. Hazell (commercial officer, Northmet Sub-Area, Eastern Electricity Board), and on Tuesday afternoon Mr. E. M. Ackery (E.D.A.) will speak on "Electric Space Heating." "Publicity" is the title of the morning paper on Wednesday by Mr. D. Atkins (director of Mather & Crowther, Ltd.), while on Wednesday afternoon Mr. R. G. Magnus-Hannaford (principal of the College for the Distributive Trades) will speak on "Retail Selling." The first paper on Thursday will be given by Mr. E. C. Lennox (manager, Wear Sub-Area, North Eastern Electricity Board), who will speak on "Domestic Sales Development." On Thursday afternoon Mr. N. H. Bridge (commercial development officer, North Western Electricity Board) will speak on "Demonstration as an Active Force in Load-Building." Friday morning at the Connaught Rooms will be occupied in a general discussion on the six papers and any other relevant matter and the proceedings will conclude with the conference luncheon.

English Electric Developments

The English Electric Co., Ltd., has recently taken over premises from the Ministry of Supply, at Whetstone, Leicester, which were previously occupied by the National Gas Turbine Establishment. The work to be carried out there by the company will be largely research and development associated with power station engineering. Industrial gas turbine development will continue, and in addition, extensive facilities for mechanical engineering laboratory work will be provided at Whetstone. Development work already being undertaken at the company's Rugby works on steam turbines, water turbines and diesel engines will be extended at the new premises.

Metal Industries Expansion

Metal Industries, Ltd., has announced the formation of a new subsidiary company, Metind, Ltd., registered with an authorized capital of £100,000. The new company will operate from a new factory to be constructed in the Bromborough area on land already owned by the Metal Industries group. Plans for this new development are well in hand and the cost of the first unit of approximately 50,000 sq ft, excluding office accommodation, is estimated at £300,000 including plant. Ample space is available for expansion and the initial unit, including essential services, is being laid out as the first stage of a planned development of the site. The new factory will initially undertake work of a repetitive nature including the manufacture and assembly of small sub-units required in quantity for other member companies in the group, mainly in the electrical and engineering divisions. Mr. K. N. Swash has been appointed chairman and managing director. The other directors are Mr. F. R. Livock and Mr. T. D. Turner.

As we reported in our last issue Metal Industries, Ltd., is taking over as from 1st April next the business of

the Rheostatic Co., Ltd., relating to the manufacture and sale of unbreakable resistors for use with heavy electrical equipment. The Igranic Electric Co., Ltd., who form part of the electrical division of the Metal Industries group, will handle the resistance trading for the group. In addition the Igranic Electric Co. will continue to develop and manufacture types of resistances specifically designed for use on traction equipment and for other special purposes.

Another acquisition by Metal Industries, Ltd., is the whole issued share capital of Finney Presses, Ltd., Birmingham. This company manufactures hydraulic accumulators for the aircraft industry and for industrial use, hydraulic presses for the plastics and other industries, and hydraulic equipment generally.

Instrument Industries' Exhibition

The third British Instrument Industries' Exhibition to be held at Earls Court, London, from 28th June to 9th July next will be the largest of its kind. It will show the latest equipment of manufacturers of scientific and electrical instruments, industrial meters, automatic controls, scientific glassware, drawing office equipment, and their associated manufacturers. The exhibition is sponsored by the following Associations:—The British Electrical and Allied Manufacturers' Association; the British Industrial Measuring and Control Apparatus Manufacturers' Association; the British Lampblown Scientific Glassware Manufacturers' Association; the Drawing Office Material Manufacturers' and Dealers' Association; and the Scientific Instrument Manufacturers' Association of Great Britain. Concurrently with this Exhibition the 10th International Printing Machinery and Allied Trades' Exhibition will be held at Olympia and in view of the rapidly growing importance of instrumentation to the printing industry, visitors to this will have the advantage of studying both modern printing machinery and the appropriate field of instrumentation, including temperature control.

Electronics Exhibition

In conjunction with the Wolverhampton and Staffordshire Technical College, Hawnt & Co., Ltd., 59, Moor Street, Birmingham, 4, are organizing an exhibition, "Electronics in Industry," to be held in the College hall on 1st, 2nd and 3rd February.

Electrification of Iraq

Some particulars of the £300 million second five-year development plan of the Iraq Government were given in the *Financial Times* of 18th January. The plans include water supply, roads, railways and bridges and industrial undertakings. A project for the production of electric power, drawn up by the J. G. White Engineering Co., of New York, provides for the setting up of power stations in Northern, Central and Southern Iraq. This is to be carried out over a period of twenty years and the ultimate capacity will be 500 MW.

It is proposed to invite offers from British, American and European consulting engineers for the preparation of the final specifications of the Northern plant, with an initial capacity of 30 MW and costing about £4 million. The station will use natural gas from the Kirkuk oilfields and will supply power to the provinces of Mosul, Arbil, Kirkuk and Suleimanyiah.

The complete electrification programme is estimated to cost £39 million; it will include a 60 MW crude-oil station in Baghdad to serve six central provinces, and a 40 MW natural-gas station at Basrah to serve three southern provinces.

"From Strength to Strength"

On Thursday last week there was a private showing in London of a film made for Permali, Ltd., by the Big Six Film Unit entitled "From Strength to Strength," the successor of the company's earlier film, "Strength Where You Need It." The film, which runs for about 40 minutes, shows the many applications of "Permali" densified wood laminates in the heavy electrical, steel, coal-mining and textile industries, in the course of which visits are made to the works of many well-known manufacturers of electrical plant and equipment, both in the United Kingdom and on the Continent. The film is primarily intended for showing abroad and the commentary, which is excellent, is being translated into several languages.

Automatic Control in Industry

Tributes to the work of the British Industrial Measuring and Control Apparatus Manufacturers' Association (BIMCAM) were paid by Sir Roger Duncalfe, president of the British Standards Institution, and Sir Edward Boyle, M.P., Parliamentary Secretary to the Ministry of Supply, at the annual luncheon of the Association held at Londonderry House, London, on 18th January. Sir Edward Boyle stressed the great importance of the Association's work for the small firm as well as the large, and referred to the shortage of control engineers which his Ministry, with the Ministry of Education, was trying to put right.

Sir Roger Duncalfe paid tribute to the Association's Handbook. The stage now under development was moving forward from the automatic control of the individual operation to the automatic linking of a series of these controlled operations to a master electronic device controlling the movement of material from one process to the next with an accuracy of prediction and a delicacy of adjustment exceeding anything human control or judgment could achieve. If we were to have greater plenty, we must, with an ageing population living on pension and a working population desiring shorter hours of work, be ever searching for ways and means of reducing the man-power content of our goods; we could not afford to use man-power where an instrument could do the job as well or better. He believed that the controlling instrument was the most powerful factor of all.

Windmill Generators for India

The Madhya Pradesh Electricity Board, New Castle Buildings, Seminary Hills, Nagpur, has told the United Kingdom Trade Commissioner in Bombay that it is interested in receiving from United Kingdom manufacturers, full technical and descriptive particulars of windmills to be used in the generation of electricity for small and isolated rural holdings. This information is required in order that the Board may correctly assess the potentialities of such installations on various sites which it has under consideration. Firms interested in this inquiry should send the required particulars direct to the Board and are asked if they would notify the United Kingdom Trade Commissioner, P.O. Box 815, Mercantile Bank Building, Mahatma Gandhi Road, Fort, Bombay, 1, that they have done so.

Cable Manufacture in Singapore

The thousandth mile of submarine cable manufactured by Cable & Wireless, Ltd.'s new factory at Bukit Chermin, Singapore, is completed. Production began at the factory in May, 1953. It was built at a cost of £232,000 to replace the old factory at Singapore, which was opened in 1887. When working at full capacity it is capable of manufacturing about 800 nautical miles of submarine cable of all types annually, for the maintenance and development of the 20,000-mile sections in the Far East of the company's 150,000-mile Commonwealth cable system. The manager is Mr. C. Campbell.

Contract Price Formulæ

The British Electrical and Allied Manufacturers' Association has issued the figures for its contract price adjustment formulæ. In each case the rate of pay for adult male labour at 15th January is deemed to be 150s 6d. The cost of material figures are:—

For electrical machinery and equipment the Board of Trade index figure published on 15th January is 168·3.

For turbo-generating and allied plant: Materials used in mechanical engineering industries, 155·7, blast furnaces and iron and steel smelting and rolling (40 and 41), 146·8. The price of ¾in o/d 18 s.w.g. brass condenser tubes (*Metal Bulletin*, 14th January) is 3s 10⅝d per lb. Outstanding contracts covered by the B.O.T. intermediate products index: The index figure for intermediate products (15th January) is 369·2.

Encouraging Electric Heating

A resolution that the London Electricity Board should be asked to make space heating appliances available on hire-purchase terms was adopted by the Area Electricity Consultative Council at its recent meeting. Mr. G. H. Randolph Martin said that the gas industry seemed to be "getting away" with the space heating business. Mr. W. Howes condemned the use of coal fires in prefabricated bungalows in densely populated places, saying that the areas around them were smothered with pungent fumes from the low chimneys.

Housecraft Advisers' Conference

The annual Conference of Housecraft Advisers and Senior Demonstrators, organized jointly by the Electrical Association for Women and the Electrical Development Association, will be held in London from 22nd to 25th March. The first two days' proceedings will take place in the Royal Empire Society's Hall, Northumberland Avenue, W.C.2. On the third day delegates will meet at the Institution of Electrical Engineers, while the venue on the fourth day will be the Connaught Rooms, Great Queen Street (off Kingsway).

A.S.E.E. London Branch

The first meeting in the new year of the Central London Branch of the Association of Supervising Electrical Engineers was held recently in the Holophane Lighting Demonstration Theatre at Westminster. Following the business of the meeting Mr. J. G. Holmes, chief technical officer of Holophane, Ltd., gave a lecture illustrated by lantern slides on industrial lighting.

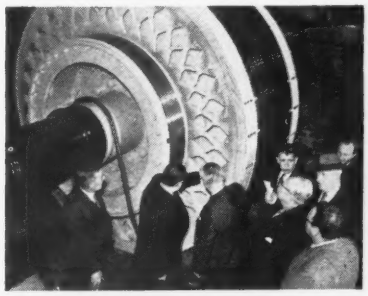
Stockholm Fair

The British Pavilion at St. Erik's Fair, Stockholm, which will be held from 27th August to 11th September next, will be much larger than the Pavilion of the 1954 Fair, and will cover an area of 20,000 sq ft. Among the products in which good business was done at the last Fair were electrical equipment, including domestic appliances. Few goods now require import licences for Sweden. Information about the British Pavilion and the Fair generally can be obtained from the sole agents of the Fair in Britain, Thirza West Publicity, Ltd., 141, New Bond Street, London, W.1 (telephone: Mayfair 3701).

Works Visit

On 18th January the Mexican Ambassador in London, Sr. De Icaza, visited the main works of the British Thomson-Houston Co., Ltd., at Rugby. He was accompanied by Sr. Gustavo Luders De Negri (the Minister Counsellor); Sr. J. R. Roldan, chief engineer of Aserraderos Gonzales Ugarte S.A.; and Sr. Lic. Javier O. Aragon, the agent for B.T.H. plant and apparatus in Mexico. Representatives of B.T.H. Export Co. with the visitors included Mr. E. V. Small (managing director), Mr. W. C. Scott (manager, western sales) and Mr. T. J. Carter (regional representative for Central America).

The visitors were welcomed by Mr. E. H. Ball (managing director, B.T.H. group of companies) and Mr. L. J. Davies (director of research and education). Some of the sections of



The Mexican Ambassador in London visits the B.T.H. Rugby Works : the party inspecting the armature of a 2,200 h.p. rolling-mill motor

the research laboratories were inspected and several demonstrations were arranged. After lunch with B.T.H. directors, the party visited the heavy plant factories and the new overspeed test house. Amongst the equipment the visitors saw under construction was a 33ft 3in diameter fabricated stator frame for the first of two 60,000 kW, 150 r.p.m. vertical waterwheel alternators for the State Electricity Commission of Victoria's Eildon power station, Australia. One of the machines being erected for test in the turbine factory which aroused particular interest was the second 2,500 kW gas-turbine alternator set for Nairobi South power station. Some time was also given to a tour of the motor factory.

Silicones Exhibition

An exhibition on the history, production and application of silicones is to be held at the Chamber of Commerce, New Street, Birmingham, from 28th February to 5th March next. The exhibition is entitled "Silicones for Industry" and invitations can be obtained on request from Midland Silicones, Ltd., 19, Upper Brook Street, London, W.1.

Standardizing Motor Sizes

In mentioning the new range of standard motors introduced by Lancashire Dynamo & Crypto, Ltd. (*Electrical Review*, 21st January, p. 105), we said that this was a direct answer to the American action in *raising* their dimensions and ratings. The italicized word should have been "revising."

Trade Announcements

Burford Taylor & Co., Ltd., have removed to Burtayco House, Church Street, Middlesbrough.

Matthews & Yates, Ltd., have transferred their London office to larger premises at 135, Rye Lane, Peckham, London, S.E.15 (telephone: New Cross 6571 (4 lines)).

Catalogues and Lists

CONDUIT FITTINGS.—Loose-leaf catalogue of cable lugs, solderless terminals, crimping tools and equipment.—**Erma, Ltd.,** Hong Kong Works, Exhibition Grounds, Wembley, Middx.

DOMESTIC EQUIPMENT.—Price lists of water heaters (WH2036) and electric cookers (C2054).—**Simplex Electric Co., Ltd.,** Creda Works, Blythe Bridge, Staffs.

A thumb-indexed trade reference catalogue illustrating the company's complete range of domestic appliances, together with price list.—**Morphy-Richards, Ltd.,** 6, Conduit Street, London, W.1.

GENERATING SETS.—A range of literature covering the company's diesel generating equipment and self-priming pumps.—**Auto Diesels, Ltd.,** Uxbridge, Middx.

Two technical leaflets illustrating the "Uniporn" diesel generating sets.—**Porn & Dunwoody, Ltd.,** Union Works, Bear Gardens, London, S.E.1.

GENERATION.—"Electrical Plant for Power Generation" a technical brochure illustrating and describing air-cooled and hydrogen-cooled alternators.—**General Electric Co., Ltd.,** Witton, Birmingham, 6.

LIGHTING FITTINGS. — Illustrated catalogue of "Aristocrat" lighting fittings, wall brackets, table lamps, etc.—**Allen & Pope, Ltd.,** 14, Shacklewell Lane, London, E.8.

Leaflet illustrating a range of oval glassware commercial fittings.—**Cryselco, Ltd.,** Kempston Works, Bedford.

Sectionalized catalogue of "Mazda" lamps for heating, photographic, motor car and decorative lighting, and a priced broad sheet on fluorescent lamps and fittings.—**British Thomson-Houston Co., Ltd.,** Crown House, Aldwych, London, W.C.2.

RELAYS.—Brochure dealing with the "Record" range of moving coil relays.—**Record Electrical Co., Ltd.,** Broad Heath, Altrincham, Cheshire.

SILVER PLATING.—36-page technical booklet dealing in a practical manner with the various operations involved in silver plating (1851).—**Johnson, Matthey & Co., Ltd.,** Hatton Garden, London, E.C.1.

SWITCHES.—Illustrated technical catalogue dealing with the "Winkler" switch, together with price list.—**Painton & Co., Ltd.,** Kingsthorpe, Northampton.

SWITCHGEAR.—Nine illustrated pamphlets: Automatic semaphore indicators (469); sine-wave alternator sets (783); Class GA flameproof air break products (1132); Type TJG biased induction relays (1213); Series B auxiliary relays (1258); Type L42T vertical isolation switchgear for service up to 750 MVA and 33 kV (1273); Type 33PI oil-break switches (1279); Class JB flit-plugs (756) and control boards (1248).—**A. Reyrolle & Co., Ltd.,** Hebburn, Co. Durham.

Three leaflets describing new developments in the company's range of flameproof contactor starters (1390, 1410 and 1290/2) and a leaflet on an automatic contactor unit for capacitor switching (K350).—**Belmos Co., Ltd.,** Bellshill, Lanarks.

WELDING.—Pocket electrode guide, a thumb-indexed booklet dealing with the company's range of welding electrodes.—**Metropolitan-Vickers Electrical Co., Ltd.,** Trafford Park, Manchester, 17.

GENERATION AND DEVELOPMENT

N.E. Supplies Extensions

At the quarterly meeting of the North Eastern Electricity Consultative Council at Newcastle-on-Tyne it was reported that during September, October and November last high voltage supplies were afforded to 19 industrial and commercial consumers. Some 166 miles of cables and mains were commissioned and 270 new sub-stations were brought into use, the majority of these being for supplies to villages and farms. Agricultural premises connected during the period numbered 376 and negotiations were completed for connecting another 340. Thirteen villages were brought on supply. The Board had approved estimates amounting to £924,000 covering electricity supply plans.

Higher Consumption in Ulster

Electricity purchases by the Northern Ireland Electricity Board from the Joint Statutory Committee rose from approximately 398 million kWh in 1953 to 460 million last year, an increase of 16 per cent, while sales advanced from 335 million to 385 million kWh. More than 8,000 new consumers were connected, 2,500 in urban and 5,500 in rural areas. They included 2,100 farms, the largest number ever connected by the Board in a year; at the end of the year the number of farms served exceeded 10,000. During 1954 the Electricity Board sanctioned expenditure amounting to £1,110,351 on extensions, system improvements, etc.

Policy on Hire and Hire-Purchase

Asked by the South Eastern Electricity Consultative Council to consider the desirability of extending to seven years the hire-purchase period for electric cookers, the S.E. Electricity Board has pointed out that extension to five years came into force as recently as July last, so that the full effect of the change cannot yet be measured. The Board has, however, agreed to consider the matter when the h.p. scheme is next reviewed. It mentions, incidentally, that in spite of the more favourable terms offered by the gas industry, cooker sales by the South Eastern Gas Board showed a smaller percentage increase in 1953-54 than those of "Seeboard."

In reply to a suggestion that when next reviewing its policy in relation to hire and hire-purchase the Board should bear in mind the special needs of rural workers, the Board says that it would be difficult to defend as fair an extension of hire privileges exclusively to a special class of consumer. Arrangements are already in force for the transfer of hire-purchase agreements when a consumer moves to another address either inside or outside the Board's area, which should meet the case of many of those whose employment results in a change of residence. A limited quantity of second-hand cookers and water heaters is already available for hire.

Electricity Sales in December

Details were given last week (page 100) of the rise in electricity output. The accompanying table analyses the Area Boards' sales for December and the whole of 1954. The national figures show an increase over December, 1953, of 12·8 per cent, but when corrected for weather conditions, which were colder than a year earlier, and the number of effective working days (27·44 against 27·54), the increase is 11·7 per cent. It will be seen that the South Western Board has made a notable advance.

Opposition to North Wales Bill Withdrawn

The Merioneth County Council last week decided to rescind a resolution which it passed at its previous meeting opposing the North Wales Hydro-Electric Bill for a pumped storage scheme to cost £15 million at Tan y Grisiau. This decision was taken after Mr. C. M. Jones, of Bala, had submitted a report of a special committee on the question, which recommended that no objection should be entered in view of assurances given by the British Electricity Authority on several points raised by the County Council, and of consultations with other bodies affected by the proposals.

Referring to the Ffestiniog railway, part of the track of which would be made unusable by the scheme as it stands, the report said that the B.E.A. was looking into the possibility of meeting the committee's wishes, which were to permit the railway to operate from Portmadoc to Blaenau Ffestiniog.

Power Station Ash Disposal

A conference called by Northumberland County Council has been held at Newcastle-on-Tyne to discuss the British Electricity Authority's scheme for a new £30,000,000 power station near Bedlington. The conference was private and discussed, in particular, the proposed system of ash disposal. Originally, it is understood, the B.E.A. proposed to take the ash out to sea in barges for dumping in deep water. The latest idea, however, is to sluice the ash, after it has been treated, into the sea from a pipe-line on Cambois beach. Local authorities on the coast, including Blyth, Whitley Bay and Tynemouth, are concerned that this method may cause pollution of their beaches. It is also feared that the inshore fishing industry may be adversely affected. A public inquiry into the scheme is to be held at Bedlington on 8th February.

Transfer of Supply from N.C.B.

The North Eastern Electricity Board is expected to take over the electricity supply to about 200 houses in the Shiney Row area at Houghton-le-Spring from the National Coal Board in the near future. The Electricity Board will build a new substation to reinforce the system.

Farm or Hamlet?

A dispute has arisen between the North Eastern Electricity Board and the owner of Bradford House Farm, Belford (Northumberland), regarding the supply of electricity to the farm and eight cottages on the land. The Board says it will cost £1,214 to provide a supply and has asked the owner of the farm to contribute £814 towards the cost. The owner, how-

ELECTRICITY SENT OUT BY AREA BOARDS FOR THEIR CONSUMERS

Area Board	Totals for December (million kWh)			Twelve Months Totals Ended 31st December (million kWh)		
	1953	1954	Inc. or Dec. %	1953	1954	Inc. or Dec. %
London	576·4	636·5	+10·4	5,604·7	6,067·7	+ 8·3
South Eastern	330·7	369·2	+11·7	3,312·2	3,644·3	+10·0
Southern	388·7	446·5	+14·9	3,898·2	4,335·8	+11·2
South Western	189·4	227·2	+19·9	1,893·3	2,228·1	+17·7
Eastern	538·3	608·5	+13·0	5,387·1	5,942·9	+10·3
East Midlands*	451·9	509·6	+12·8	4,622·3	5,086·5	+10·0
Midlands*	616·5	678·7	+10·1	6,142·3	6,828·0	+11·2
South Wales*	326·6	369·7	+13·2	3,480·2	3,950·9	+13·5
Merseyside & N. Wales*	343·7	393·7	+14·5	3,448·2	3,915·0	+13·5
Yorkshire*	591·1	658·9	+11·5	6,020·6	6,632·1	+10·2
North Eastern*	345·3	382·2	+10·7	3,614·4	3,928·3	+ 8·7
North Western*	671·8	736·7	+ 9·7	6,718·6	7,396·8	+10·1
South East Scotland	139·2	157·2	+12·9	1,291·3	1,450·6	+12·3
South West Scotland*	334·4	369·4	+10·5	3,102·6	3,418·1	+10·2
Total all Area Boards	5,844·0	6,544·0	+12·0	58,536·0	64,825·1	+10·7
Direct Supplies by Central Authority	88·0	147·1	+67·2	961·3	1,284·4	+33·6
Grand Total	5,932·0	6,691·1	+12·8	59,497·3	66,109·5	+11·1
Mainly Industrial Areas*	3,681·3	4,098·9	+11·3	37,149·2	41,155·7	+10·8
Mainly Non-Industrial Areas	2,162·7	2,445·1	+13·1	21,386·8	23,669·4	+10·7

* Those in which industrial consumers took over 50% of the total sales in the preceding financial year.

ever, contends that as the farm has eight cottages on the land it should be classed as a hamlet and supplied with electricity free of charge. As the Electricity Board will not agree to this proposal, the farm owner intends to appeal to the Ministry of Agriculture.

Tunnelling Record

Driving 428ft in seven working days a tunnelling crew of the Mitchell Construction Co. has achieved a new British and European tunnelling record. This record was established in the St. Fillan's section of the North of Scotland Hydro-Electric Board's Breadalbane project. Since the work commenced in August, nearly 9,000ft of tunnel has been driven on six different headings.

Saturday Opening of Showrooms

As the showrooms of the South Eastern Gas Board are now open all day on Saturdays some members of the South Eastern Electricity Consultative Council has suggested that "Seeboard" should do likewise. It has been reported to the Council that as an experiment the Board's showrooms at East Grinstead are being opened on Saturday afternoons for a period of six months and further discussion of the matter has been deferred until the results of the experiment are known.

Canadian Transmission Line

Completion of the Lillooet to Ashcroft transmission line of the B. C. Electric Co. over a distance of 60 miles has brought power to the lower Cariboo area of British Columbia. In the wild terrain of the Hat Creek and Bonaparte Valleys and on Elephant Mountain it was found impossible to employ the normal tractors and cars in construction, and horses had to be used. For the spanning of the Fraser River rockets first carried a pilot line across.

Electricity in Holland

The Netherlands Bureau of Statistics has published a detailed review of the production and consumption of electricity since the war. In 1939 consumption amounted to 4,064 million kWh and after falling during the German occupation to 1,843 million kWh, a speedy recovery set in and the pre-war level was exceeded in 1947, to be followed by a further period of vigorous growth. In 1953 consumption amounted to 9,592 million kWh. Per capita consumption was 914 kWh in 1953 against 633 in 1949, 199 in 1945 and 463 in 1939. After import surpluses in the years 1950-52, a small export surplus was registered for 1953.

Hydro-Electric Development in Turkey

An error occurred in the map reproduced in the article bearing the above title in our issue of 31st December (p. 1043). Hirfanli, where the Kizilirmak River is being developed, is east of Ankara and south of Kirikkale and not on the Aegean Sea coast as shown in the map.

Progress in Venezuela

From Mr. J. H. Appleby, who has been a consultant of the company since early last year, we have received a copy of the report of La Electricidad de Caracas, the largest electricity supply company in Venezuela, for the first half of 1954. Progress in Caracas, the capital city, has been very rapid; the load is doubled every four years. During December the maximum demand was 126 MW against 100 MW a year earlier.

The total capacity of the plant at the company's Arrecifes steam power station is being raised to 148 MW by the installation of a new 37·5 MW set.

Work is proceeding on the new Tacoa plant and it is hoped that the boiler for the first unit will be delivered by July. This undertaking will eventually have a capacity of 280-320 MW in six units.

Plans have been drawn up for a 69 kV line between Santa Rosa and Convento (10 km) and extensions of the 33 kV system have included further stretches of gas-filled cable.

The total power generated during the first half of 1954 was over 267 million kWh, about 27 million by water-power plant and by the Ayala steam plant. The rest came from the steam stations at Arrecifes, La Guaira and El Cortijo. The Arrecifes plant produced 197 million kWh—about 74 per cent of the total.

Blizzards in Scotland

Helicopter Used to Restore Supplies

A helicopter was used successfully by the North of Scotland Hydro-Electric Board in restoring power supplies to isolated consumers in Caithness and Sutherland cut off during recent severe blizzards.

On Saturday, 15th January, Mr. W. Smith, the Board's linesman at Thurso, set out in an attempt to walk to Reay, carrying with him a supply of h.v. fuses required to replace others damaged by weather. After trekking through deep snow for 20 miles he managed to attend to four transformers but failed in his attempt to reach Reay. On the following day, carrying a parcel of fuses and his operating rod, he again tried to reach the cut-off communities, this time on board the Thurso lifeboat when it sailed to land urgent food supplies on the north coast of Sutherland. He was, however, prevented by high seas from landing anywhere along the coastline; at Portskerra the lifeboat crew could only go close enough inshore to throw food to crofters waiting on the beach.

It was agreed that when the first call came in requesting the services of a helicopter to aid the snowbound communities the parcel of fuses would be put on board and dropped where Hydro-Electric Board contractors' workmen had marked out large "E's" in the snow. On Tuesday, 18th January, a helicopter left Wick Airport to bring in an urgent hospital case from Bettyhill. With it went a parcel of fuses and successful drops resulted in power being restored later on the same day to the Strathy, Portskerra and Melvich areas.

Despite the severity of the blizzard only 2 per cent of the Hydro-Electric Board's consumers in Caithness and Sutherland areas were without electric power.

Three of the Board's linesmen and a transformer were dropped by helicopter near John O'Groats on Thursday, 20th January, to restore electricity supplies after a transformer had been damaged during the blizzards. The men were landed successfully and set about replacing the transformer on top of its pole. By late Thursday afternoon power supplies were restored.

Special Pye v.h.f. radio equipment was used by linesmen engaged in inspecting lines and restoring electricity supplies to isolated farms and crofts during the blizzards. The equipment was installed in the Board's Thurso office, which became temporary radio headquarters for those engaged in rescue work.

A transformer being loaded aboard a helicopter to restore electricity supplies at John O'Groats

Financial Section

STOCKS and SHARES

FOR another week in the Stock Exchange there was a continuation of the tendency for gilt-edged stocks and industrial ordinary shares to follow opposite courses. At the beginning of this week, Government securities suffered further heavy losses, without, however, putting any material drag on prices of the popular industrials. Reasons for the depression in the gilt-edged market can be deduced from the interest which mounts towards midday on each successive Thursday, the traditional time for announcing changes in Bank Rate. The event of the week has been the stupendous success of Colvilles issue, which attracted subscriptions for some thirteen times the ten million shares offered. Release of the huge sums temporarily tied up in applications was expected to increase market activity.

Domestic Appliances

Shares in companies concerned with the production of household equipment continue to provide one of the most active corners of the industrial market. The impression of high prosperity in this field found confirmation in the latest issue of the Treasury's "Bulletin for Industry," which reports boom conditions in what it calls domestic durable goods, particularly electrical appliances such as washing machines. Detailed figures for retail sales show that hardware and electrical goods achieved during the greater part of last year one of the largest increases in any group. The pace has quickened, of course, since the Government decided last July to relax the restrictions on the terms of hire-purchase, which is evidently the basis on which a high proportion of current transactions is being done.

Market Reactions

The enthusiasm with which investment has fastened upon the implications of the rising trend in the sale of household goods can be measured by the behaviour of securities connected with it. Comparison of some present prices with those ruling shortly before the announcement of hire-purchase reliefs last summer shows, for instance, gains of 12s in Hoover, now 49s 3d; of 11s 3d in Morphy-Richards at 30s; of 19s in Vactrics at 33s 9d; of 4s in British Vacuum Cleaners at 17s; of 6s 3d in Parnall (Yate) at 12s 9d; and of 17s 6d in J. & F. Stone at 40s. In addition, the same influence has made a substantial contribution to the advance of the "radio" group, in which the persistent rise of prices has been a subject for weekly comment here for months past.

Some of the best performances of the week were again credited to radio shares: Pye and Thorns both gained a further half-crown, Ekco rose 2s and Plessey 1s. Westinghouse advanced by as much as 7s 6d (following a rise of 3s 9d in the previous week) in anticipation of the new railway development

Week's Price Changes

Company or Board	Nom. Value	Middle price 24th Jan.	Week's Rise or Fall	Dividend Previous	Dividend Last	Yield %	1954 Highest	1954 Lowest
Gilt-edged Stocks						£ s d		
Brit. Elec. 1968/73	100	92½	−2	3	3	3 4 10	97	88¾
Brit. Elec. 1974/77	100	91½	−2	3	3	3 5 6	96½	87½
Brit. Elec. 1976/79	100	96½	−2	3½	3½	3 12 5	101½	93 9/16
Brit. Elec. 1974/79	100	107½	−1	4½	4½	3 19 1	111½	103 7/16
Overseas Electric Supply								
Calcutta Elec.	£1	22/-		6†	6†	5 9 0†	24/6	18/7
East African Power	£1	22/6		7	7	6 4 6	23/4	19/6
Nigerian Elec.	£1	22/6		10	10	8 17 10	25/-	23/6
Palestine Elec. "A"	£1	22/-		Nil	Nil	—	21/-	16/-
Perak Hydro-Elec.	£1	20/-		6	10	10 0 0	20/-	13/9
Equipment and Manufacturing								
Aberdare Cables	5/-	13/3	−3d	25	12½*	4 14 3	14/3	8/1
Aerialite	1/-	12/-	−3d	88⅛	88⅛	7 7 3	14/6	10/9
Allen, W. H.	£1	79/6		15	20	5 0 8	78/6	50/-
Aron Elec. Ord.	£1	56/6		20	15	5 6 4	60/-	43/-
Assoc. Elec. Ord.	£1	70/-		20	11¼*	—	62/6	41/6
Automatic Tel. & El.	£1	72/-	+9d	15	15	—	73/-	57/3
Babcock & Wilcox	£1	72/-		18	12*	3 6 8	76/3	47/3
Baldwin, H. J.	2/-	4/6		20	20	8 17 9	5/6	3/9
Bakelite	10/-	28/9		12½	12½	4 7 0	32/-	23/6
British Aluminium	£1	41/6	+9d	12	10	4 16 6	41/-	33/9
B.I. Callender's	£1	49/3		10	10	4 1 3	52/-	37/9
B I. Callender's 6% Pref. ...	£1	26/-	−3d	6	6	4 12 3	26/6	24/3
British Thermostat	5/-	25/-	−1/3	35	27½*	—	28/-	12/-
British Vac. Cleaner	5/-	17/-		15	25	7 7 0	14/6	11/6
Brook Motors	10/-	42/6		20	20*	—	45/6	29/3
Brush Ord.	5/-	8/9	+9d	4	6	3 8 6	8/3	3/6
Bulgin, A. F.	1/-	5/-	+3d	30	30	6 0 0	4/3	3/2
Burco	5/-	21/3		35	25*	5 17 9	21/6	12/1
Chloride El. Storage "A" ...	£1	68/-	+1/6	20	12½*	3 13 6	69/6	46/6
Clarke Chapman	£1	74/-		17½	20	—	73/-	47/6
Cole, E. K.	5/-	23/-	+2/-	25	27½	2 19 9*	20/-	11/6
Cossor, A. C.	5/-	10/6		10	10	4 15 3	11/-	7/-
Crabtree	10/-	30/6	+6d	17½	20	6 11 3	32/-	23/9
Crompton Parkinson Ord. ...	5/-	18/3	+9d	20	20	—	17/9	11/6
De La Rue	5/-	22/6	+9d	Nil	20	4 9 0	24/-	12/3
Decca	4/-	57/-	+6d	35	56¼*	3 19 0	56/6	32/-
Desoutter	5/-	26/3		18	20	3 16 4	26/6	16/1
Dewhurst	2/-	7/9		19	24	6 4 0	7/6	5/1
Dictograph Tel.	2/-	7/3		20	20	5 10 4	8/-	5/2
Dubilier Condenser	1/-	5/3		25	25	—	5/3	3/3
E.M.I.	10/-	29/3	+2/9	8	10	3 8 6	27/9	11/3
Electrical Components	5/-	17/3		20	20	5 16 0	16/3	10/9
Elec. Construction	£1	33/9		15	15	4 9 0*	35/-	26/6
Enfield Cable Ord.	£1	21/3		5	Nil	Nil	26/3	16/6
English Electric	£1	60/-	+3/9	15	10*	3 6 8	59/-	38/-
English Electric 3½% Pref. ...	£1	16/6	−3d	3½	3½	4 11 0	16/9	15/3
Ericsson Tel.	5/-	35/-	+1/3	22†	25†	—	33/9	22/9
Ever Ready	5/-	24/9	+9d	35	40	—	26/3	17/9
Falk Stadelmann	£1	50/6	+2/-	15	15	5 18 9	49/-	36/6
G.E.C. Ord.	£1	60/-		11½	12½	4 3 4	60/-	37/6
G.E C. 6½% Pref	£1	28/9		6½	6½	4 10 6	28/9	26/6
General Cables	5/-	16/9	+3d	30	30	8 19 0	18/-	16/3
Greenwood & Batley	£1	55/-		17½	17½	6 7 3	55/-	40/3
Hackbridge Cable	5/-	15/9		20	20	6 7 0	15/9	11/3
Hackbridge & Hewittic	5/-	24/6		20	25	5 2 0	25/-	16/10
Hall Tel. Acc.	10/-	12/-		10	10	8 6 8	13/-	10/6
Heatrae	2/-	5/6		12½	12½	4 11 0	5/6	4/-
Henley's	10/-	18/-	+6d	10½	10½	5 16 9	22/-	15/6
Holophane...	5/-	17/3	−3d	20	25	7 5 0	18/-	13/1

* After capital bonus. † Free of income tax.

The above quotations are based upon middle prices in the Stock Exchange Daily Official List.

plans. Publication of the figures showing last year's record rate of motor-car production was reflected in improvements of 2s 6d in Lucas and 1s 6d in Chloride Electrics. Reyrolle and Parsons were 5s apiece to the good, and English Electrics rose to £3. In a long string of other advances, mention may be made of those in Brush, Cromptons, Falk Stadelmann, Switchgear & Cowans, Southern Areas and Ericssons.

in Electrical Investments

Company or Board	Nom. Value	Middle price 24th Jan.	Week's Rise or Fall	Dividend Previous	Dividend Last	Yield % £ s d	1954 Highest	1954 Lowest
Equipment and Manufacturing—continued.								
Hoover	5/-	49/3	+6d	25	45	4 11 6	51/-	26/3
I.C.I.	£1	45/-	+1/3	13	15	3 6 8	43/6	26/6
Intl. Combustion	5/-	29/-	−1/6	15	20	3 9 0	30/-	14/6
Johnson & Phillips	£1	45/9		15	15	6 11 3	52/6	45/6
Lancashire Dynamo	£1	56/3	+6d	12½	14	5 0 6	59/6	43/-
Laurence, Scott	5/-	14/9		15	20	3 7 9*	14/9	7/-
Lister, R. A.	£1	33/-xd	+2/9	12	9·3	5 12 9	33/-	22/6
London Elec. Wire	£1	54/-	+6d	15	10*	3 14 0	54/-	38/-
Lucas, J.	£1	46/3	+2/6	10·8	7½*	3 4 9	49/-	25/3
Marryat & Scott	2/-	9/6		22½	25	5 5 3	9/6	5/11
Mather & Platt	£1	56/-	+3/-	12½	15	—	53/-	32/-
Metal Industries	£1	34/-	+1/9	12	9	5 6 0	42/3	29/6
Midland Elec. Mfg.	£1	43/9		15	15	—	43/9	31/6
Morphy-Richards	4/-	30/-		40	35*	4 13 4	27/6	11/4
Murex	£1	52/6	+6d	15	15	5 14 3	57/-	49/-
Newman Ind.	2/-	3/-	+6d	10	10	6 13 4	2/6	2/-
Oldham & Son	1/-	3/3		17½	17½	5 7 9	3/4	2/5
Parnall (Yate)	5/-	12/9	+4½d	6	8	3 2 9	11/-	4/3
Parsons, C. A.	£1	65/-	+5/-	12½*	7½*	2 6 3	60/-	38/1
Plessey	10/-	70/-	+1/-	30	20*	2 17 2	64/-	37/10
Pye Deferred	5/-	39/-	+2/6	20	20*	2 11 3	37/-	15/7
Revo	10/-	14/6	−6d	27½	9*	6 4 2	20/3	14/-
Reyrolle	£1	£5	+5/-	12½	13⅓	2 15 0	92/6	66/-
Rheostatic	4/-	15/6		19	20	5 3 3	15/9	11/-
Richardsons Westgarth	5/-	12/3	+1/-	15	15*	6 2 6	12/3	6/6
Scottish Cables	4/-	20/-	+6d	20	27½	5 10 0	21/9	12/1
Siemens Ord.	£1	49/-	−1/6	10	10	4 1 8	44/-	33/9
Smith (England), S.	4/-	17/6		15	17½*	4 0 0	17/6	7/8
Southern Areas	£1	32/6	+1/3	6	7½	4 12 4	32/6	17/6
Strand Elec.	5/-	9/9		17½	17½	8 19 6	10/3	8/3
Sturtevant	5/-	21/6		18·1†	18·9*†	—	22/9	14/6
Sun. Elec.	£1	33/9		15	15	8 17 9	33/9	27/6
Switchgear & Cowans	5/-	12/6	+1/-	22½	10	4 0 0	13/7	9/9
Taylor Tunnicliff	5/-	11/3		25	12½*	5 11 0	12/4	10/7
T.C.C.	10/-	42/6	+1/3	20	30*	—	41/3	21/3
T.C. & M.	£1	38/9		10	8⅓*	4 7 8	37/6	30/3
Telephone Mfg.	5/-	9/6		10	10	5 5 3	9/6	7/6
Thorn Elec.	5/-	32/6	+2/6	12½	20	3 1 6	30/6	13/3
Thornycroft	£1	39/-	+1/6	25	25	—	39/6	26/6
Tube Investments	£1	85/-	+2/6	15	17½	4 2 3	81/3	60/3
Vactric	5/-	33/9	+5/-	Nil	10	1 9 7	24/6	7/6
Veritys	5/-	9/-		10	12½	6 19 0	10/6	5/-
Walsall Conduits	4/-	52/6		70	70	5 6 8	52/6	44/-
Ward & Goldstone	5/-	42/6	−3d	45	50	—	43/6	21/-
Watford	2/-	6/9		25	22½*	—	7/3	4/7
Westinghouse Brake	£1	93/9	+7/6	16	18	3 16 9	86/3	60/9
West, Allen	5/-	20/9	+1/9	15	17½	4 4 4	19/6	12/7
Wolf Electric	5/-	16/6		15	17½	5 6 0	17/6	11/-
Trusts, Transport and Communications								
Anglo-Am Tel.:								
A Ord.	100	83	−1½	6	6	7 4 6	89½	80
Ord.	100	52½	−2	3½	3½	7 2 10	55½	52
Anglo-Portuguese	£1	24/9		—	8	6 9 4	25/9	21/-
Brit. Elec. Traction:								
Def. Ord.	5/-	23/6	+1/6	35	50	—	24/-	13/-
Cable & Wireless:								
Ord.	£1	47/-	+6d	8	9	3 16 4	42/9	26/2
4% Loan	100	99½	+1	4	—	4 0 5	98½	95½
Calcutta Trams	£1	21/-	+6d	2½†	6†	5 14 3†	24/6	17/1
Cape Elec. Trams	£1	17/-		5½	7	8 4 9	17/6	12/4
Marconi Marine	£1	34/-		10	10	5 17 8	35/-	27/6
Oriental Tel. Ord.	£1	102/-		16	16	—	101/3	82/6
Telephone Props.	£1	90/-		—	—	—	92/6	74/6
Telephone Rentals	5/-	11/3	+3d	10	10	4 9 0	11/-	9/-

Radio Finance

Electric & Musical Industries announce that finance for the acquisition of the common stock of Capitol Records, the American firm, is to be found by the issue of three million new 5½ per cent second preference shares. These will be offered to holders of the various existing stocks at a price to be notified at a time nearer the issue date, which will follow as soon as possible after the holding of the necessary meeting on 11th February. E.M.I. ordinary shares have been fluctuating on either side of 29s 6d. Decca stockholders have open to them at the moment the offer of new ordinary shares at 15s which are being dealt in at a premium of 43s, and of £250,000 4½ per cent notes at 98½, which the market expects will command a moderate premium in due course. Later, and subject to approval, a one-for-two scrip issue is to be distributed to the ordinary stockholders in the form of non-voting "A" shares.

Pye New Preference

The new 5½ per cent preference shares recently offered to Pye, Ltd., stockholders at 21s can be bought in the market at around 21s 9d, and a purchase will be free of the usual 2 per cent transfer stamp duty until about Wednesday next (3rd February). They show a yield of just over 5 per cent, which looks favourable by comparison with the current return from many other well-secured industrial preference stocks. The freedom from stamp duty saves the buyer about 4½d per share in expenses.

Metal Industries

The £1 shares of Metal Industries took an active turn for the better after news of the company's expansion plans, which include the acquisition of certain electrical equipment manufacturing interests from the Rheostatic Company. The financial year of Metal Industries runs to March, and the results appeared last time in July. Reduction of the dividend rate on that occasion from 12 to 9 per cent has since had the effect of keeping the price of the shares at a comparatively subdued level. After being down to 30s, however, they had been showing signs of a revival before last week's announcements, upon which they rose 1s 9d to 34s. The yield on the basis of last year's payment is 5¼ per cent.

R. A. Lister Results

An improvement of 2s 9d in R. A. Lister £1 shares, to 33s ex dividend, marked satisfaction with the company's final dividend declaration and preliminary profits statement. A two-for-five scrip issue has been made since the publication of last year's results. Allowing for this, the final payment of 7½ per cent for the year ended last September, makes a total equivalent to 9·3 per cent on the present capital of £3,640,000.

REPORTS and DIVIDENDS

Electric Furnace Co., Ltd.—At an extraordinary general meeting held on 18th January resolutions were approved for capitalizing profits and making a capital issue of one fully paid ordinary share for every ordinary share held, and for capitalizing profits and making a capital issue of fully paid 5½ per cent cumulative preference shares to the holders of the 7 per cent cumulative preference shares in return for their surrendering their rights to 1½ per cent dividend per annum. The issue will be made in the proportion of three such shares for every eleven 7 per cent cumulative preference shares held.

Electric & Musical Industries, Ltd.—In our last issue we reported that E.M.I. was to buy a majority holding in Capitol Records of Hollywood. It is now announced that the purchase will be financed by an offer of 3,000,000 5½ per cent £1 cumulative second preference shares to preference, ordinary and note holders. The amount which the company may invest overseas is restricted by the conditions attached to the £2,000,000 4 per cent notes 1953-58 issued in 1948. Notice has therefore been given to repay these notes on 15th April at 100½ and it is proposed to replace this finance by an issue of £2,000,000 unsecured loan stock 1970-75 to preference, ordinary and note holders at the same time as the offer of the new second preference shares. An extraordinary meeting will be held on 11th February.

R. A. Lister & Co., Ltd.—The group profits for the year 1953-54 amount to £859,019, as compared with £607,099 for the preceding year, and after allocating £570,773 for taxation, the net profit attributable to R. A. Lister & Co. is £307,156 (against £220,835). It is proposed to pay a final dividend of 7½ per cent on capital increased by a free scrip issue of two-for-five, which with an interim dividend paid on the smaller capital, makes 10 per cent for the year. For 1952-53 the total distribution was 12 per cent.

The India Rubber, Gutta Percha & Telegraph Works Co., Ltd., reports a group profit for the year to 30th September last of £374,074, as compared with £216,572 for 1952-53. Taxation requires £188,815, and the net profit is £185,259 (£105,801) to which is added £49,142, taxation and other items over-provided. The dividend for the year on the preferred ordinary is 8 per cent, and on the ordinary, 9 per cent (both unchanged).

L. Sterne & Co., Ltd.—The profit for the year to 31st October last, after deducting £40,000 for taxation, is £44,102, as compared with £68,974 for the previous year. General reserve receives £15,000 and it is proposed to maintain the dividend for the year at 15 per cent. The balance carried forward is £71,914 (against £68,057 brought in).

New Companies

Reading Electronics, Ltd.—Registered 5th January. Capital £100. Radio, television, electrical and general engineers, etc. Directors: D. V. Cursons and Barbara W. Cursons. Regd. office: Commerce House, 8, Blagrave Street, Reading.

Nuclear Engineering, Ltd.—Registered 4th January. Capital £100. To design, manufacture and deal in appliances, apparatus, instruments and machinery for medical, surgical, scientific, domestic and industrial and other uses, including appliances making use of radioactive or fissionable materials of all kinds, etc. Directors: H. T. Eatwell and S. Stein. Solicitors: Allen & Overy, 3, Finch Lane, E.C.3.

Colvern Holdings, Ltd.—Registered 6th January. Capital £100. To acquire the whole of the issued share capital of Colvern, Ltd., and to carry on the business of electrical and mechanical engineers and contractors, manufacturers of and dealers in electronic components for radar, television and resistances of all kinds, etc. The first directors are to be appointed by the subscribers. Regd. office: Mawneys Road, Romford, Essex.

W. Cutter & Co., Ltd.—Registered 6th January. Capital £1,000. Mechanical engineers and contractors, manufacturers of and dealers in dynamos, motors, armatures, magnetos, batteries, etc. Directors: W. F. Cutter and R. H. Foster. Regd. office: Central Works, Central Road, Morden, Surrey.

A. F. Jemison, Ltd.—Registered 6th January. Capital £2,000. Electrical engineers and contractors, domestic, heating and ventilating engineers, radio and television engineers, etc. Directors: A. F. Jemison and Joan Jemison. Regd. office: 9, Mowbray Road, Forest Hall, Newcastle-on-Tyne.

Grays (Hythe), Ltd.—Registered 6th January. Capital £1,000. Manufacturers and repairers of and dealers in electrical and mechanical apparatus and accessories and components, particularly radio and television sets, etc. Directors: W. W. Gray and Edith Gray, both of Grays Garage, Dibden Purlieu, Southampton.

E.D.A. Installations, Ltd.—Registered 24th December. Capital £1,000. To carry on the business of manufacturers of and dealers in electric motors, transformers and dynamos, etc. Directors: B. Gomersall and E. J. Loveridge (directors of Electrical Drive Applications, Ltd.) and R. Righton. Secretary: Rebecca Brady. Regd. office: 6, Fitzroy Square, London, W. 1.

A. F. Richards, Ltd.—Registered 12th January. Capital £2,000. Electricians, dealers in radio, electrical, television, public address and recording apparatus, etc. Directors: Gladys W. Richards and A. J. Richards. Regd. office: 53, Teign Bank, Hinckley.

Bankruptcies

D. A. Wadsworth, 3, Kelvin Court, Chiswick, Middx, electrician.—Public examination 11th March at the Court House, Half Acre, Brentford.

W. D. Newall, 55, Duke Street, Padstow, Cornwall, radio and electrical engineer.—Trustee, Mr. B. Russell, 25, Market Place, Camelford, Cornwall, released 1st December, 1954.

W. J. Layton, 148, Studley Road, Redditch, Worcs, formerly residing and carrying on business at 102, Evesham Street, Redditch, electrical engineer.—First and final dividend of 9s 9d in the £, payable on and after 28th January at the Official Receiver's Office, Somerset House, 37, Temple Street, Birmingham, 2.

TRADE MARKS

APPLICATIONS have been made for the registration of the following trade marks. Objections may be entered up to 12th February:—

McLAREN (design). No. 726,374, Class 7. Internal combustion engines (not for land vehicles), and electric generators incorporating such engines; and parts.—J. & H. McLaren, Ltd., Airedale Works, Hunslet Road, Leeds, 10.

PEDIGREE. No. 730,046, Class 7. Power-operated hair clipping machines (not for personal use). — Wolseley Sheep Shearing Machine Co., Ltd., Electric Avenue, Witton, Birmingham, 6.

ADAMAID. No. 733,257, Class 7. Automatic dish washing machines.—Ajax Domestic Appliance Co., Ltd., West Mount Works, Johnson Street, Halifax.

MIRRLEES (design). No. B734,218, Class 7. Steam condensers, vapour compressors, feedwater de-aerators, centrifugal pumps; steam ejector air pumps, steam turbines, feedwater heaters, heat exchangers (being parts of machines) and sugar cane crushing mills.—Mirrlees Watson Co., Ltd., 45, Scotland Street, Glasgow, C.5.

No. 732,710 (design), Class 9. Instruments, apparatus, systems, and parts for the production, transmission, reproduction, control, measurement or indication of signals of sound wave frequency, of carrier wave signals modulated at sound wave frequency or of television or other image signals.—Central Rediffusion Services, Ltd., Carlton House, Lower Regent Street, London, S.W.1.

LOMA. No. 734,424, Class 9. Scientific instruments and apparatus.—Loma Electronic Equipment, Ltd., 27-29, Union Street, Southwark, London, S.E.1.

SHAVEX. No. 734,870, Class 9. Electric rectifiers.—Electronic Speciality Co., Los Angeles, California, U.S.A. Address for service, c/o Marks & Clerk, 57 and 58, Lincoln's Inn Fields, London, W.C.2.

ANALMATIC. No. 736,085, Class 9. Scientific apparatus and instruments; and electrical apparatus and instruments.—Baird & Tatlock (London), Ltd., 14-17, St. Cross Street, London, E.C.1.

FLEURLITE. No. 735,805, Class 11. Lighting installations and parts and fittings.—Siemens Electric Lamps & Supplies, Ltd., Caxton House, Tothill Street, Westminster, London, S.W.1.

NEXT WEEK'S EVENTS

Organizers of electrical functions are advised to make use of the "Electrical Review" clearing house, Room 231, Dorset House, Stamford Street, London, S.E.1, to ascertain that proposed dates for their functions do not clash with others already arranged

Monday, 31st January

BOURNEMOUTH.—Grand Hotel, 8.15 p.m. A.S.E.E. Bournemouth Branch. "Electricity without Tears," by F. G. Hart; and "Industrial Heating Applications," by R. J. Webb.

EDINBURGH.—Charlotte Rooms, 8.30 p.m. I.E.E. South-East Scotland Sub-Centre. Joint dance with the Institution of Civil Engineers.

HULL. — Y.E.B., Ferensway, 7.30 p.m. I.E.S. Leeds Centre. "Prescribing for Seeing," by M. L. Berson.

LONDON.—At the Royal Society of Arts, John Adam Street, 7 p.m. Institution of Electronics. "Intensification of the X-Ray Image for Medical Diagnosis," by Dr. A. Nemet.

Tuesday, 1st February

EDINBURGH.—Carlton Hotel, North Bridge, 7 p.m. I.E.E. South-East Scotland Sub-Centre. "Applications of Electronic Computors," by B. W. Pollard, R. A. Sheppard and D. T. N. Williamson. (Short papers.)

ELTHAM.—Congregational Church Hall, Court Road, 8 p.m. A.S.E.E. South East London Branch. "Lifts."

HAMMERSMITH. — Windsor Castle Hotel, 134, King Street, 7.30 p.m. A.S.E.E. West London Branch. "We will go to Mars," by R. Lennox Napier.

LEEDS.—The University, 6.30 p.m. I.E.E. North Midland Centre. "Modern Developments in Atomic Energy," by Dr. T. E. Allibone.

LONDON.—Savoy Place, 5.30 p.m. I.E.E. Measurements Section. "Electrical and Magnetic Measurements in an Electrical Engineering Factory," by D. Edmundson; and "Current Summations with Current Transformers," by A. Hobson.

At the Royal Society of Arts, John Adam Street, 7 p.m. Incorporated Plant Engineers, London Branch. Debate on "That this world would be a better place in which to live had the internal combustion engine never been invented."

MANCHESTER. — Engineers' Club, Albert Square, 6.15 p.m. I.E.E. North-Western Centre. "A Transatlantic Telephone Cable," by Dr. M. J. Kelly, Sir W. Gordon Radley, G. W. Gilman and R. J. Halsey.

OLD PORTSMOUTH. — B.E.A. Conference Rooms, High Street, 7.30 p.m. A.S.E.E. Portsmouth Branch. "Light in Industry," by Mr. Bellamy.

STOKE-ON-TRENT.—M.E.B., 31, Kingsway, 6 p.m. I.E.S. Stoke-on-Trent Group. "Sports Lighting," by M. W. Peirce.

Wednesday, 2nd February

EDINBURGH.—12, Rothesay Place, 7 p.m. I.E.S. Edinburgh Centre. "Studies in Interior Lighting," by J. M. Waldram.

GLASGOW.—39, Elmbank Crescent, 7 p.m. I.E.E. South-West Scotland Sub-Centre. "A Study of Some of the Properties of Materials Affecting Valve Reliability," by Dr. E. A. O'Donnell Roberts.

HARRINGAY.—"Queen's Head," 677, Green Lanes, 7.45 p.m. A.S.E.E. North London Branch. "Diesel Engines," by R. W. S. Mitchell.

LEICESTER.—Bell Hotel, 6.30 p.m. Institution of Heating and Ventilating Engineers, East Midlands Branch. "Heating Engineers' Electrical Installations," by P. Moore.

LONDON.—Savoy Place, 6.30 p.m. I.E.E. London Students' Section. "The Generation of Electricity in Britain," by J. Eccles (President).

35, Grosvenor Place. Women's Engineering Society, London Branch. "The Work of the British Standards Institution," by L. G. Watkins.

MIDDLESBROUGH.—At the Cleveland Scientific & Technical Institution, 6.30 p.m. I.E.E. Tees-Side Sub-Centre. North-Eastern Centre Chairman's Address, by G. W. B. Mitchell.

NEWCASTLE-UPON-TYNE. — Bolbec Hall, 6.30 p.m. I.E.E. North Eastern Students' Section, Tyneside meeting. Joint meeting with Students' Section of the North East Coast Institution of Engineers and Shipbuilders.

Roadway House, 8, Oxford Street, 6.15 p.m. I.E.S. Newcastle Centre. "Lighting for Ships," by T. Catten.

PORTSMOUTH. — College of Technology, 6.30 p.m. I.E.E. Southern Centre. "The Breaking of a.c. Circuits," by Cdr. (L) E. W. Goodman. (Joint meeting with the Southern Students' Section.)

PRESTON. — 49a, Fishergate, 7.30 p.m. A.S.E.E. Preston Branch. "Electronic Equipment in Industry," by C. J. Teece.

RUGBY.—College of Technology & Arts, 6.30 p.m. I.E.E. Rugby Sub-Centre. "Measurement of the Winding Resistance of a 132 kV Power Transformer in Service," by Dr. K. J. R. Wilkinson and J. D. Harmer.

STAFFORD.—At the English Electric Co.'s Lecture Room, Salt Avenue/Sabine Street, 7.15 p.m. I.E.E. North Staffs. Sub-Centre Students' Section. "Reference Devices for Industrial Regulators," by B. T. Downing.

SWANSEA.—S. Wales Electricity Board, The Kingsway, 6.30 p.m. I.E.S. Swansea Group. "Outdoor Illuminations," by H. Carpenter.

Thursday, 3rd February

BRISTOL.—Crown and Dove Hotel, Bridewell Street, 7 p.m. I.E.E. Bristol Students' Section. Informal meeting.

CARDIFF.—S. Wales Electricity Board, The Hayes, 5.45 p.m. I.E.S. Cardiff Centre. "Outdoor Illuminations," by H. Carpenter.

CROYDON.—Café Royal, North End, 8 p.m. A.S.E.E. South London Branch. "Atomic Energy," by Dr. Hughes.

GLASGOW.—39, Elmbank Crescent, 7.30 p.m. I.E.S. Glasgow Centre. "Studies in Interior Lighting," by J. M. Waldram.

LONDON.—Savoy Place, 5.30 p.m. Institution of Electrical Engineers. "A Criterion of Distribution Cost," by D. J. Bolton. (Supply Section paper.)

At the Lighting Service Bureau, 2, Savoy Hill, 6.30 p.m. Chief Technical Assistants' Association. "Some Impressions from the United States of America," by L. H. Welch.

Manson House, Portland Place, 7.30 p.m. Institute of Welding, North London Branch. "Electric Welding in a Large Shipbuilding Yard," by R. J. W. Rudkin.

NORWICH.—7.30 p.m. Institute of Welding, Eastern Counties Branch. "Maintenance and Repair by Gas and Electric Welding," by A. Bishop and D. Jones.

NOTTINGHAM.—E.M.E.B., Smithy Row, 6 p.m. I.E.S. Nottingham Centre. "Lighting for Sport," by M. W. Peirce.

Friday, 4th February

BIRMINGHAM.—Grand Hotel. I.E.E. South Midland Centre. Annual dinner.

LIVERPOOL.—9, The Temple, 24, Dale Street, 7.30 p.m. A.S.E.E. Liverpool Branch. "Electronics in Industry," by A. Williams.

MANCHESTER.—Lesser Free Trade Hall, Peter Street, 7 for 7.30 p.m. I.E.E. North-Western Utilization Group. Dinner-dance.

Engineers' Club, Albert Square, 6.45 p.m. Manchester Association of Engineers. "Some Problems Associated with the Selection of Machine Tools for Heavy Engineering Production," by J. Henderson.

SOUTHAMPTON.—Court Royal Hotel, 7.30 p.m. Incorporated Plant Engineers, Southampton Branch. Annual dinner.

SWANSEA.—I.E.S. Swansea Group. Annual dinner and dance.

WEMBLEY PARK. — The Century Hotel, Forty Avenue, 8.15 p.m. A.S.E.E. North West London Branch. Technical films by P. A. Thorogood.

WORKINGTON.—Technical College, 7 p.m. I.E.E. North-Eastern Centre, district meeting. "Design, Performance and Application of Miniature Circuit-Breakers," by H. W. Wolff and T. G. F. Atherton.

Saturday, 5th February

LONDON.—I.E.E. London Students' Section. Visit to Westminster Abbey at 11 a.m.

Gas Turbine Tanker

On the occasion of the launching of the tanker *Vexilla* recently Mr. J. W. Platt, chairman, Shell Tankers, Ltd., and managing director, Anglo-Saxon Petroleum Co., Ltd., said that as a result of the successful experiments his organization had decided two years ago to place an order with Cammell Laird for a new 18,000 ton tanker to be powered exclusively by two gas turbine units. They had not at that time seriously tackled the problem of direct mechanical transmission, the solution of which for the gas turbine was felt to be still some distance ahead.

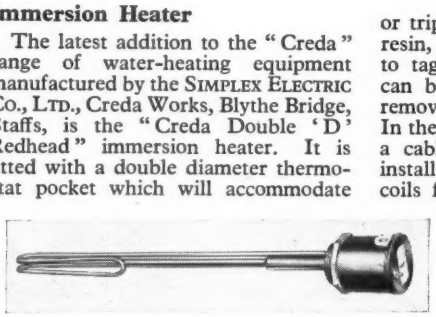
It seemed at that time that mechanical or hydraulic transmission for a gas turbine engine had not been carried to the stage when it could confidently be installed in a new ship which was required to operate as a normal trading unit of the company's fleet. Since then and before the keel of the new ship was ready the pace of development accelerated, not only in the company's own work but in the programme of gas turbine development in the United States and by the efforts and studies made by others in this country. In view of this a change of plan had been decided upon which in essence was to jump what might be an unnecessary interim stage.

Instead of fitting a gas turbine unit into a new ship it was proposed to strip all the present machinery from the *Auris* and to substitute a single 5,500 h.p. gas turbine engine of improved performance and design. At the same time the problem of direct mechanical transmission was being tackled and a form of direct gearing coupled to a fixed propeller was being designed. This should lead fairly quickly to the prototype of the ideal unit and for this purpose the *Auris* would in effect be turned into a floating laboratory. Mr. Platt thanked the British Thomson-Houston Co., Ltd., and Cammell Laird for all that they had done, and were doing, to help in this development work.

NEW ELECTRICAL EQUIPMENT

Immersion Heater

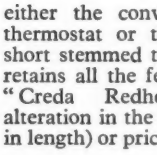
The latest addition to the "Creda" range of water-heating equipment manufactured by the SIMPLEX ELECTRIC CO., LTD., Creda Works, Blythe Bridge, Staffs, is the "Creda Double 'D' Redhead" immersion heater. It is fitted with a double diameter thermostat pocket which will accommodate either the conventional rod pattern thermostat or the "Sunvic T.Q.B." short stemmed type. The new heater retains all the features of the original "Creda Redhead" without any alteration in the range (11 to 36 inches in length) or price.



"Creda Double 'D' Redhead" immersion heater

Industrial Lampshade

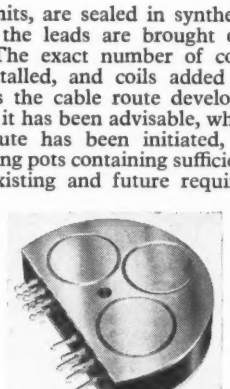
A new "Mazda" translucent plastic shade recently produced by the BRITISH THOMSON-HOUSTON CO., LTD., Crown House, Aldwych, W.C.2, provides a 45 deg cut-off to light centre, and is for use in schools and commercial areas. The fitting is designed for 150 W tungsten lamps and consists of a moulded white urea formaldehyde shade which presses on to the sprung sections of a pressed steel gallery with ventilation holes and a 1⅛in central hole to fit the standard b.c. lampholder. The overall length is 10$\frac{13}{32}$in and the maximum diameter is 10$\frac{29}{32}$in. The price is 19s 4d plus 3s 7½d purchase tax in the United Kingdom.



"Mazda" translucent plastic shade

Telephone Cable Loading Coils

By making available coils cast in resin, the Equipment Division of MULLARD, LTD., Century House, Shaftesbury Avenue, London, W.C.2, has greatly simplified the process of telephone cable loading. The coils are designed to fit neatly inside the sleeve used for a normal cable splice or simple combined loading and jointing unit. For example, for the loading of a conventional fourteen-pair cable the splice loading point would be 19in long by 3in overall diameter, only slightly larger than a normal joint. The coils, which are made up in single or triple units, are sealed in synthetic resin, and the leads are brought out to tags. The exact number of coils can be installed, and coils added or removed as the cable route develops. In the past it has been advisable, when a cable route has been initiated, to install loading pots containing sufficient coils for existing and future requirements, otherwise the number of loading coils could only be altered by changing the pots.



Mullard resin-cast "Ferroxcube" cored loading coil (triple assembly)

The new coils result in adaptable loading systems. Only one cable splice is required instead of the normal two, the coils are readily accessible, and there is no iron pot or stub cable. An additional advantage is that if it is desired to fill the cable with gas under pressure, there is a free passage through the loading points.

These "L" series coils use "Ferroxcube" magnetic material, which results in an improved performance compared with the dust-cored coils previously used. The resistance is practically constant over the working frequency range, so that equalization is unnecessary. The coils may be stacked close together without danger of cross talk and the various electrical characteristics can be adjusted to the tightest possible tolerances. Owing to their low effective resistance at the higher frequencies, the coils are suitable for high quality programme circuits or carrier frequency loading.

Pneumatic Convertor

A highly sensitive convertor providing an immediate air output signal on the standard 3-15 lb/sq in range, directly proportional to the input signal from thermocouples or other low d.c. potential sources, has just been announced by ELLIOTT BROTHERS (LONDON), LTD., Century Works, London, S.E.13.

Designed for ready assembly into process control panels or incorporation into recorder/controller loops, the convertor comprises a chopper unit for rendering the d.c. signal as an a.c. input to a high-gain three-stage a.c. electronic amplifier, stabilized in respect of mains voltage variation, and operating an "Eltair" electro-pneumatic unit via a phase sensitive rectifier.

Provision is included for rapid "in the field" conversion to any of five input range spans. There is also a d.c. supply, stabilized by a precision neon stabilizer to permit the incorporation of cold junction compensation, range suppression or resistance thermometer operation. A monitoring gauge of robust moving coil construction, scaled in mV input and lb/sq in output, provides local indication of the operation of the convertor. Supplies to the convertor are 200/250 V a.c. or 110 V 50 c/s a.c. and a supply of instrument air.

For process control systems requiring a ready and economic means of recording temperatures, and of furnishing an input source for two or three term pneumatic control functions, this new thermo-electric pneumatic convertor provides a compact and versatile general purpose unit.

Floor Polisher

The new floor polisher made by the GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, London, W.C.2, is double insulated for maximum safety in service and will not interfere with radio or television reception. It differs from previous designs in that it is of metal construction, has a plastic handle, brush guard and buffer and all corners are rounded to prevent damage to furniture.

It is fitted with two bristle brushes and the loading is 270 W. All standard voltages are catered for.

The price of the DM.342 polisher, complete with brushes and felt pads, is £19 10s plus £7 2s 7d purchase tax in the United Kingdom.

G.E.C. DM.342 electric floor polisher

NEW PATENTS

Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (2s 8d each including postage) will be obtainable after 2nd March from the Patent Office, 25, Southampton Buildings, London, W.C.2.

1952

5699. Apps, R. E.—Earth leakage indicator. 3rd March, 1953. (725141.)

9198. Compagnie Générale de Télégraphie sans Fil.—High tension lead-in insulators. 10th April, 1952. (725143.)

9475. Elliott Bros. (London), Ltd.—Waveguide coupling devices. 15th April, 1953. (725144.)

1953

1004. Bornand, R.—Machine for the manufacture of flexible tubing, electric cable coverings and the like. 13th January, 1953. (725151.)

1654. General Electric Co.—Polyphase electric transformers. 20th January, 1953. (725290.)

1813. Telefunken Ges. für Drahtlose Telegraphie.—Frequency modulated circuit arrangements. 21st January, 1953. (725292.)

2456. British Thomson-Houston Co., Ltd. —Commutators for electrical apparatus. 1st February, 1954. (725157.)

3794. General Motors Corporation.—Electrical meters. 11th February, 1953. (725164.)

3911. Nippon Denshin Denwa Kosha.—Line fault welding device for communication cables. 11th February, 1953. (725307.)

3914. Siemens-Schuckertwerke Akt.-Ges. —Regulating unit for electric lighting installations. 11th February, 1953. Addition to 672460. (725433.)

4005. Soc. d'Exploitation de Brevets.—Dynamo-electric machines. 12th February, 1953. (725165.)

5151. Telefonaktiebolaget L. M. Ericsson. —Electrical device for frequency comparison. 24th February, 1953. (725321.)

5403. Philips Electrical Industries, Ltd.—Frequency stabilized oscillators. 26th February, 1953. (725325.) 5536. Television receivers. 27th February, 1953. (725326.)

5599. Patent Management, Inc.—Electric inductances. 27th February, 1953. (725329.)

6273. Standard Telephones & Cables, Ltd.—Circuit arrangement for influencing the frequency response of a.f. amplifiers. 6th March, 1953. (725174.)

6428. Standard Telephones & Cables, Ltd.—Fault alarm arrangements for electric communication circuits. 9th March, 1953. (725444.)

6703. Ateliers de Constructions Electriques de Charleroi.—Dielectric-loss heating apparatus. 11th March, 1953. (725179.)

7160. Air Preheater Corporation.—Apparatus for the electrical precipitation of particles suspended in gases. 16th March, 1953. (725344.)

7760. Philips Electrical Industries, Ltd.—Methods of making electric discharge tubes. 20th March, 1953. (725450.)

7825. Standard Telephones & Cables, Ltd.—Rotary switching devices. 20th March, 1953. (725186.) 7828. High frequency transmission line systems. 20th March, 1953. (725187.)

7885. Westinghouse Electric International Co.—Apparatus for controlling the supply of current from a polyphase source of alternating current to a load such as electric resistance welding apparatus. 23rd March, 1953. (725004.)

7911. Philips Electrical Industries, Ltd.—Television camera tubes. 23rd March, 1953. (725348.)

8524. Standard Telephones & Cables, Ltd.—Automatic synchronization. 27th March, 1953. (725190.)

8547. Edison Swan Electric Co., Ltd.—Direct voltage stabilization circuits. 27th March, 1953. (725356.)

8820. Bronzavia Soc. Anon.—Electric fluid turbines. 31st March, 1953. (725006.)

9070. Standard Telephones & Cables, Ltd.—Method of making dust cores of high permeability. 1st April, 1953. (725193.)

9151. General Electric Co.—Magnetrons. 2nd April, 1953. (725357.)

9210. Philips Electrical Industries, Ltd.—Cathode-ray tubes of the kind comprising a luminescent layer or screen. 2nd April, 1953. (725458.)

9216. Brown, Boveri & Co., Ltd.—Circuits for producing expansion and contraction of the circular electron orbit in a magnetic induction accelerator. 2nd April, 1953. (725358.)

9757. Schmidt, W. G.—Method of producing bipolar accumulator plates. 10th April, 1953. (725359.)

10223. Regie Nationale des Usines Renault.—Electric control systems. 14th April, 1953. (725464.)

10705. Standard Impianti Elettrici e Industriali Soc. per Azioni.—Electric starting means for induction motors, particularly asynchronous motors. 20th April, 1953. (725016.)

10740. Forges et Ateliers de Constructions Electriques de Jeumont.—Three-phase electric traction system. 20th April, 1953. (725465.)

11355. Standard Telephones & Cables, Ltd.—Crossbar switch. 24th April, 1953. (725368.)

11698. Westinghouse Electric International Co.—Electromagnetic induction apparatus. 28th April, 1953. (725372.)

11835. Philips Electrical Industries, Ltd. —Measuring or indicating instruments. 29th April, 1953. (725373.)

12615. Philips Electrical Industries, Ltd. —Method of fitting a rotor on a shaft by means of an intermediate bushing and products made in accordance with such methods. 6th May, 1953. (725210.)

12954. Allis-Chalmers Manufacturing Co. —Electrical apparatus with fluid cooled terminal bushings. 8th May, 1953. (725211.)

13089. General Electric Co.—Washing machines. 11th May, 1953. (725031.)

13090. General Electric Co.—Electrical connectors with printed circuit elements. 11th May, 1953. (725032.)

13175. Bosch Ges., R.—Electromagnetic oscillating armature driving units. 12th May, 1953. (725033.)

13597. Automatic Telephone & Electric Co., Ltd.—Traffic control systems. 15th May, 1953. (725475.)

13885. Philips Electrical Industries, Ltd.—Electric incandescent lamps or discharge tubes. 18th May, 1953. (725384.)

14090. Ardichvili, G.—Electric heating of rotating rollers. 19th May, 1953. (725040.)

14182. Hazeltine Corporation.—Frequency conversion apparatus for the sound-signal translating channel of a television receiver. 20th May, 1953. (725051.)

14383. Kurkjian, Y. H.—Shuttered electrical socket outlets. 21st May, 1953. (725044.)

14630. British Thomson-Houston Co., Ltd.—High pressure mercury-vapour lamps. 26th May, 1953. (725046.)

15159. Westinghouse Electric International Co.—Magnetic amplifiers. 1st June, 1953. (725223.)

16074. Telefunken Ges. für Drahtlose Telegraphie.—Circuits for effecting synchronization of electric oscillation generator. 11th June, 1953. (725481.)

16168. Telefonaktiebolaget L. M. Ericsson.—Method and means for reducing cross-talk between pulse channels in multi-channel pulse communication systems. 11th June, 1953. (725396.)

16304. Breda Elettromeccanica e Locomotive Soc. per Azoni.—Electrical switching systems, particularly for electrical heaters on railway or like vehicles. 12th June, 1953. (725230.)

16841. Landers, Frary & Clark.—Electrically heated automatic coffee maker. 18th June, 1953. (725399.)

16860. Hazeltine Corporation.—System for transmitting signals in two directions. 18th June, 1953. (725232.)

16907. Bendix Aviation Corporation.—Voltage regulating system. 13th June, 1953. (725070.)

17343. Westinghouse Electric International Co.—Dynamo-electric machines. 23rd June, 1953. (725233.)

17680. Compagnie Electro-Mecanique.—Winding head for stator coil winding machines. 25th June, 1953. (725234.) 17684. Comb device for machines for winding stators of electrical machines. 25th June, 1953. (725235.)

18536. Moore Electronic Laboratories, Inc.—Automatic electronic error correction circuit. 3rd July, 1953. (725238.)

18795. Philips Electrical Industries, Ltd. —Electrolytic capacitors. 7th July, 1953. (725080.)

19584. United-Carr Fastener Corporation. —Electrical sockets. 14th July, 1953. (725496.)

19849. Allmanna Svenska Elektriska Aktiebolaget.—Circuit arrangement for the parallel operation of transductors. 17th July, 1953. (725244.)

19999. General Motors Corporation.—Electrical plug-and-socket connector assemblies. 20th July, 1953. (725498.)

21689. General Motors Corporation.—Manufacture by die casting of rotors for electrical machines. 6th August, 1953. (725249.)

22196. Westinghouse Electric International Co.—Induction heating. 12th August, 1953. (725251.)

23124. General Electric Co.—Electrical vapour detectors. 21st August, 1953. (725515.)

23738. Maschinenfabrik Oerlikon.— Mercury vapour rectifier. 27th August, 1953. (725103.)

23808. Standard Telephones & Cables, Ltd.—Loading coil assembly. 28th August, 1953. (725104.)

24409. General Electric Co.—Dynamo-electric machines. 3rd September, 1953. (725260.)

24415. Gretener, E.—Television projection apparatus. 3rd September, 1953. (725106.)

24698. British Thomson-Houston Co., Ltd.—Stereoscopic motion pictures. 7th September, 1953. (725107.)

25651. Radio Corporation of America.—Indirectly heated cathode structure and method of assembly. 16th September, 1953. (725111.)

28756. Felten & Guilleaume Carlswerk Akt.-Ges.—Electrical deep-sea cable. 19th October, 1953. (725533.)

28805. Philips Electrical Industries, Ltd. —Amplifiers employing negative feed-back. 19th October, 1953. (725534.)

29977. Aktiebolaget Tudor. — Electric accumulators. 29th October, 1953. (725121.)

31430. Standard Telephones & Cables, Ltd.—Electrical circuits using multi-gap cold-cathode gas-filled tubes. 12th November, 1953. (725539.)

31839. Goodrich Co., B. F.—Electrically heated protective coverings. 17th November, 1953. (725125.)

32027. General Electric Co.—Automatic refrigerator control apparatus. 18th November, 1953. (725267.) 34579. Thermally insulated cabinets. 11th December, 1953. (725546.) 34580. Compression refrigerating systems. 11th December, 1953. (725547.)

32844. Philips Electrical Industries, Ltd. —High-frequency ovens. 26th November, 1953. (725550.)

CONTRACT INFORMATION

Accepted Tenders and Prospective Electrical Work

CONTRACTS OPEN

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses.

Belfast.—31st March. City Council. Plant for Power Station West. (See this issue.)

Brazil.—14th February. Comissao Estadual de Energia Eletrica, Porto Alegre. Equipment for adding a 66 kV output stage to the Sao Jeronimo transformer substation. (E.S.B. 1221/55. Ten/12316.)* 15th March. Sixteen transformers, ranging from 500 to 3,000 kVA. (E.S.B. 1212/55. Ten/12314.)*

Dagenham.—26th February. Borough Council. Street lighting equipment. (See this issue.)

Edinburgh.—North of Scotland Hydro-Electric Board. 33 kV overhead line between Arbroath and Bridge of Dun. (See this issue.)

Egypt.—8th February. State Telegraphs and Telephones Administration. Two medium frequency 5 kW radio telegraph transmitters. (E.S.B. 1401/55. Ten/12268.)* 9th February. Five short wave radio transmitters. (E.S.B. 1402/55. Ten/12261.)*

Greece.—9th February. State Procurement Service, Ministry of Finance, Athens. Rubber sheathed cables. (E.S.B. 652/55. Ten/12220.)*

India.—4th February. Government of Bihar Electricity Department. 2,000 tons of bare copper or 6,250 miles of equivalent a.c.s.p. conductors and 50 miles of all-aluminium conductors. (E.S.B. 1207/55. Ten/12241.)* 10th February. 800 tons of galvanized steel wires. (E.S.B. 1203/55. Ten/12243.)* 14th February. 1,500 33 kV and 11 kV air break switches. (E.S.B. 1206/55. Ten/12249.)* 22nd February. 71,000 pin insulators and 8,000 strain sets for use on 33 kV and 11 kV lines. (E.S.B. 1205/55. Ten/12232.)* 24th February. 840 distribution transformers. (E.S.B. 1204/55. Ten/12246.)*

10th February. Damodar Valley Corporation, Calcutta. Thirty-four oil circuit breakers and 34 air blast circuit breakers. 1st March. Control panels. (E.S.B. 928/55. Ten/12223.)* 31st March. 132 kV and 33 kV disconnecting switches. (E.S.B. 1274/55. Ten/12250.)*

26th February. Electricity Department, Allahabad. Two 3,000 kW turbo-alternator sets, complete with boilers and auxiliaries. (E.S.B. 930/55. Ten/12240.)*

28th February. Government Electricity Department, Madras. Meters. (E.S.B. 1122/55. Ten/12310.)* 15th March. A.c.s.r. conductors and insulators for telephone lines. (E.S.B. 1121/55. Ten/12309.)*

Iraq.—3rd February. Directorate General of Municipalities, Bagdad. Meters. (E.S.B. 970/55. Ten/12207.)*

Keynsham.—16th February. U.D.C. Street lighting columns and electrical equipment. (See this issue.)

Pakistan.—3rd February. Director General of Supply and Development, Karachi. Aluminium conductor. (E.S.B. 1211/55. Ten/12313.)*

Portuguese East Africa.—18th April. Ports, Railways and Transport Department, Lourenço Marques. Electrical equipment, including lamps for street lighting, fuse boxes, wall and portable telephones, telephone and lamp batteries, insulating material, voltmeter, carbon brushes, screw and spring bulb sockets, switches, adaptors, meters and insulators, etc. (E.S.B. 1060/55. Ten/12303.)*

* Specifications may be inspected at the Export Services Branch, Board of Trade, Lacon House, Theobald's Road, London, W.C.1 (Chancery 4411; extension 769).

South Africa.—10th February. Union Tender and Supplies Board. 1,200 h.p. diesel engine, generator and switchboard and one fuel pump test bench. (E.S.B. 1220/55. Ten/12323.)*

17th February. South African Railways. One storage battery operated 6,000 lb fork lift truck. (E.S.B. 1359/55. Ten/12256.)*

18th February. Electricity Department, Durban. 10,000 insulated type service cut-outs (50/60 A at 250 V); 10,000 h.r.c. 60 A non-rewirable type fuse links. (E.S.B. 1444/55. Ten/12280.)*

23rd February. Stores Department, South African Railways, Johannesburg. Electric cable. (E.S.B. 1019/55. Ten/12217.)*

Spenborough.—7th February. U.D.C. Street lighting installation. (See this issue.)

United States.—10th February. Bureau of Reclamation, Denver, Colorado. Three instrument transformers. (E.S.B. 756/55. Ten/12215.)*

ORDERS PLACED

Bicester.—U.D.C. Electrical installations in houses and flats on the western development site (£4,011).—Electrical Contracts & Maintenance Co.

Chelmsford.—Corporation. Street lighting installation.—Cohen Bros. (Electrical), Ltd.

Durham.—County Education Committee. Electrical installations in schools:—Dunston Hill County and Modern (£3,018) and Consett New Grammar (£11,398).—Steels Engineering Installations; Trimdon Grange County (£1,313).—R. Robson; Newton Aycliffe New Secondary Modern (£5,675).— R. V. Hogg and Co.

Failsworth.—U.D.C. Street lighting installation.—Cohen Bros. (Electrical), Ltd.

London.—L.C.C. Renewal and improvement of electrical installation at Poplar Technical College (£11,581).—Johnson Smith & Co., Ltd.

Luton.—Corporation Education Committee. Electrical installations in Phase 1 of new College of Further Education (£21,039).—David Thomson, Electrical Engineers, Ltd.

WORK IN PROSPECT

Particulars of new works and building chemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Acton.—Factory on Great Western estate, Park Royal Road; Henry White & Son, Ltd., heating engineers, 133, Regent Street, London, W.1.

Addington.—Factory and offices, Vulcan Way; A. Barton & Co. (Toys), Ltd., 54, East Hill, London, S.W.18.

Barnsley.—Shops and showrooms, Eldon Street and Midland Street; Cussins Group, Ltd., 6, St. Paul's Chambers, Sheffield.

Birmingham.—Flatted factories on sites at Dartmouth Street and at Holloway Head; city architect, Civic Centre, Broad Street.

Extensions to works, Hansons Bridge Road, for M. D. J. Gauge & Tool Co.; F. N. Adams, Ltd., Stratford Road, Camp Hill, Birmingham.

Blackpool.—Houses (112) and flats (27), Grange Park estate; Brown & Jackson, Ltd., Elm Street, Fleetwood.

Braintree.—First instalment of scheme for college of further education; county architect, County Hall, Chelmsford.

Breconshire.—Grammar technical boys' school, secondary modern mixed school and county college technical wing at Brecon, and county primary schools at Llandulas and Pontsticill; county architect, Rhyd Offices, Brecon.

Crawley.—Standard factories, site No. 3; Crawley Development Corporation, Broadfield.

Durham.—Technical college, Bishop Auckland (£90,000); Gordon Durham and Co., builders, East Boldon.

Ellesmere Port.—Houses (102), on North Whitby estate; surveyor, Queen Street Offices.

Gillingham (Kent).—Great Lines Senior Mixed School; borough surveyor.

Hatfield.—Dwellings (269), Angerland site; Hatfield Development Corporation, Newtown House, St. Albans Road.

Hebburn-on-Tyne. — Proposed shopping centre in Station Road area (£300,000); U.D.C. surveyor.

Ilford.—Shops, flats and offices, 281/97, Cranbrook Road; Suburban Developments (Ilford), Ltd., 667, Eastern Avenue.

Leicester.—Administrative, technical and research buildings; Metalastik, Ltd., Evington Valley Road.

London.—Flats, shops and maisonnettes in the Preverton Street area, Kensington (£347,919); J. W. Sainsbury, town clerk, Town Hall, W.8.

Loughborough.—Crematorium (£38,000); W. Granger, borough surveyor, Southfields.

Melton and Belvoir.—Houses at Asfordby, Long Clawson and Croxton Kerrial (50); R.D.C. architect, Melton Mowbray, Leics.

Minehead.—Public hall, pavilion, restaurant and dance hall, on the Blenheim Gardens site; surveyor, Urban Council Offices, Minehead, Somerset.

Newcastle-on-Tyne. — Large brewhouse, Orchard Street, for Northern Clubs Federation Brewery; C.W.S. Building Department, West Blandford Street, Newcastle.

Flats (852), Longbenton estate; city architect, 18, Cloth Market.

Factory for Knitwear Co.; H. Gatoff, architect, 51, Grainger Street.

Northolt.—C.E. church; Ralph Tubbs, architect, 35, Welbeck Street, London, W.1.

St. Helens.—Erection of phase 1 of new technical college; J. Gerrard & Sons, Ltd., Swinton, near Manchester.

St. Leonards.—Flats (47), Marina; Llewellyn (Hastings), Ltd., builders, 5, Warrior Square.

Skegness.—Secondary modern school; Evans, Cartwright & Wollatt, architects, 111, London Road, Derby.

Slough.—Assembly hall and extensions to Town Hall (£100,000); E. Gardner Thorpe, borough surveyor, Town Hall, Bath Road.

Stafford.—New buildings for Charles Clarke & Son, Ltd., Chapel Ash, Wolverhampton; Harry W. Weedon & Partners, architects, 45/47, Calthorpe Road, Birmingham, 15.

Sunderland.—Erection of industrial building (27,000 sq ft) to rehouse nine small firms displaced under the Lawrence Street clearance scheme (£34,000); borough engineer.

Old people's hostel, Hylton Red House estate (£40,000); borough architect, Grange House, Stockton Road.

Warrington.—Large extensions for Thames Board Mills; A. Monk & Co., Ltd., Padgate, Warrington.

Wellingborough.—Houses (235), Northampton Road; Council's architect.

Wimborne.—Methodist church; John S. Pantlin, architect, 125, Marylebone Road, London, N.W.1.

Workington.—Shops and offices, Oxford Street, for C. W. Murray; J. Saul, architect, National Provincial Bank Chambers, John Street.